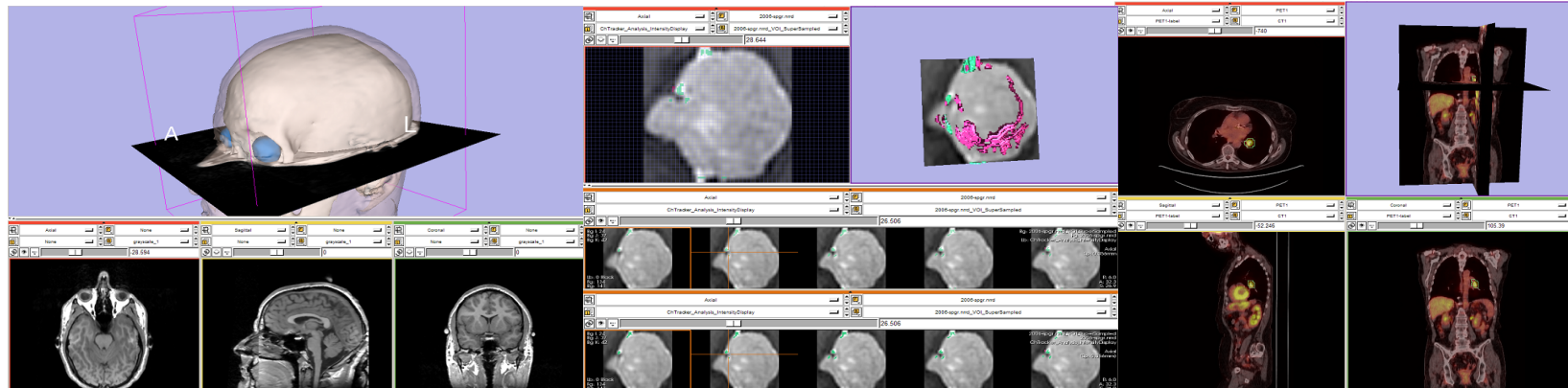




# Quantitative Analysis and Visualization with 3D Slicer



Jeffrey Yap, Ph.D.  
Ron Kikinis, M.D.  
Randy Gollub, M.D., Ph.D  
Wendy Plesniak, Ph.D.  
Kathryn Hayes, M.S.

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Kilian Pohl, Ph.D.  
Ender Konugolu, Ph.D.  
Andriy Fedorov, Ph.D.





3DSlicer

# 3D Slicer version 3 is a multi-platform software running on **Windows, Linux, and Mac OSX.**

## *Disclaimer*

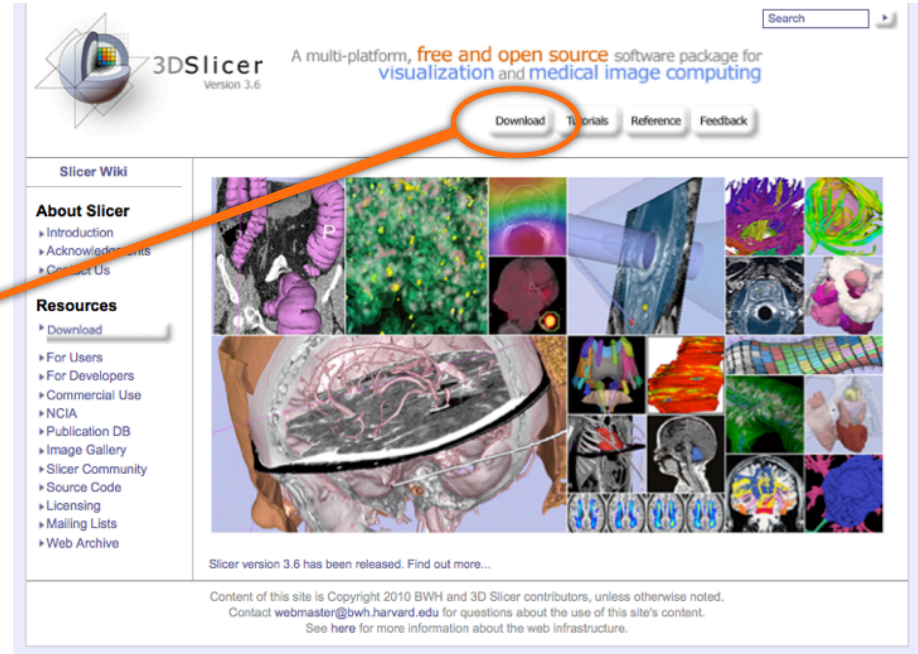
It is the responsibility of the user of 3DSlicer to comply with both the terms of the license and with the applicable laws, regulations and rules. **Slicer is a tool for research, and is not FDA approved.**

A screenshot of the 3DSlicer website homepage. The page features the 3DSlicer logo and version number (3.6) at the top left. To the right, it states "A multi-platform, free and open source software package for visualization and medical image computing". Below this, there are navigation buttons for "Download", "Tutorials", "Reference", and "Feedback". A search bar is located in the top right corner. The main content area is divided into two columns. The left column, titled "Slicer Wiki", contains sections for "About Slicer" (with links to Introduction, Acknowledgments, and Contact Us) and "Resources" (with links to Download, For Users, For Developers, Commercial Use, NCI, Publication DB, Image Gallery, Slicer Community, Source Code, Licensing, Mailing Lists, and Web Archive). The right column features a large grid of colorful 3D medical image visualizations, including brain scans, organ models, and anatomical structures. Below the grid, a message states "Slicer version 3.6 has been released. Find out more...". At the bottom of the page, there is a copyright notice: "Content of this site is Copyright 2010 BWH and 3D Slicer contributors, unless otherwise noted. Contact webmaster@bwh.harvard.edu for questions about the use of this site's content. See here for more information about the web infrastructure."



3DSlicer

- This workshop uses the newest release of 3D Slicer (version 3.6.2).
- Visit the slicer download page for Slicer 3.6 stable release, or for Slicer nightly builds.

A screenshot of the 3DSlicer website homepage. The page features the 3DSlicer logo and version number (3.6) at the top left. To the right, it states "A multi-platform, free and open source software package for visualization and medical image computing". Below this, there are four buttons: "Download", "Tutorials", "Reference", and "Feedback". The "Download" button is circled in orange, and an orange arrow points from it towards the text in the adjacent slide. The main content area includes a "Slicer Wiki" section with links for "About Slicer" and "Resources". The "Resources" section lists various links such as "Download", "For Users", "For Developers", "Commercial Use", "NCIA", "Publication DB", "Image Gallery", "Slicer Community", "Source Code", "Licensing", "Mailing Lists", and "Web Archive". A large image gallery displays various 3D medical visualizations, including brain scans, heart models, and anatomical structures. At the bottom, there is a notice about the release of Slicer version 3.6 and a copyright notice for 2010.



# Tutorial Overview

---

- Getting Started: **Slicer3 Minute Tutorial**
- Quantitative Measurement of Volumetric Change: **ChangeTracker Tutorial**
- Quantitative Measurements for Functional Imaging: **PETCTFusion Tutorial**

All Tutorial Datasets are located in **C:\slicer\_data**



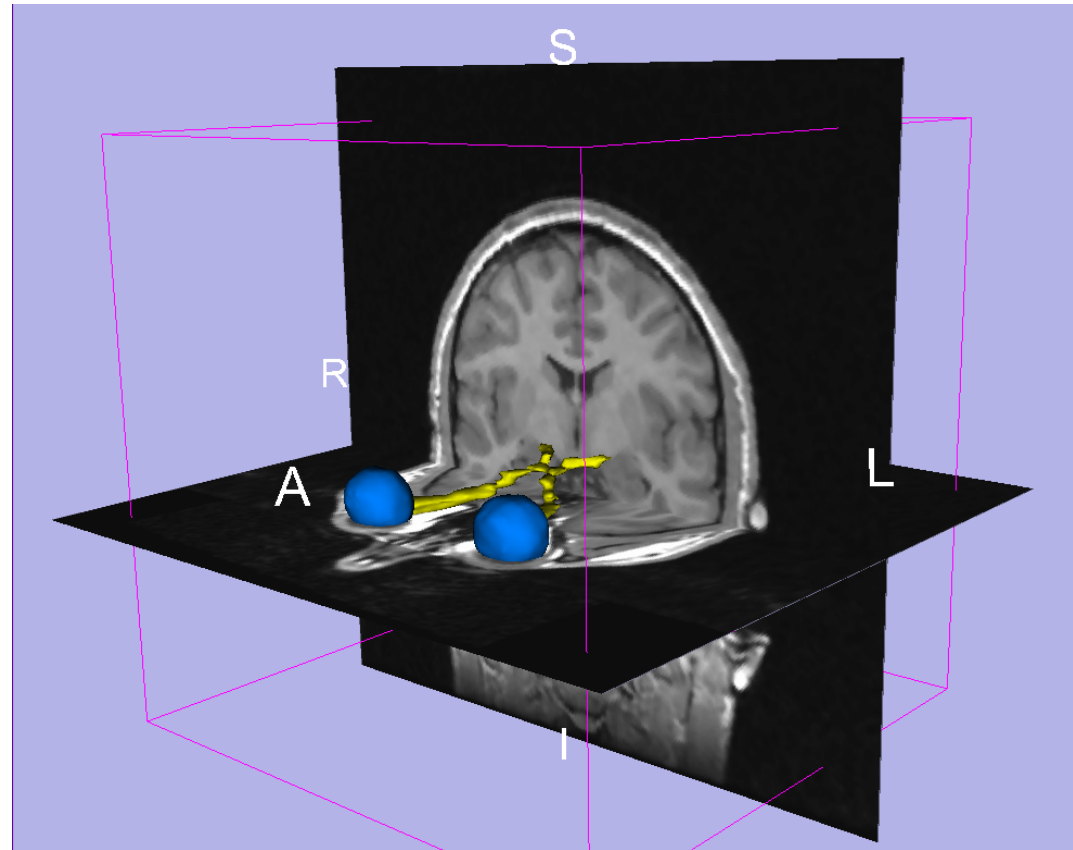
# Slicer3 Minute Tutorial

## ***Part I: Slicer3 Minute Tutorial***

Sonia Pujol, PhD  
Wendy Plesniak, PhD

This tutorial is a short introduction to the advanced **3D visualization capabilities** of the Slicer3 software for medical image analysis.

It is designed to quickly build a basic level of comfort with the Slicer software.



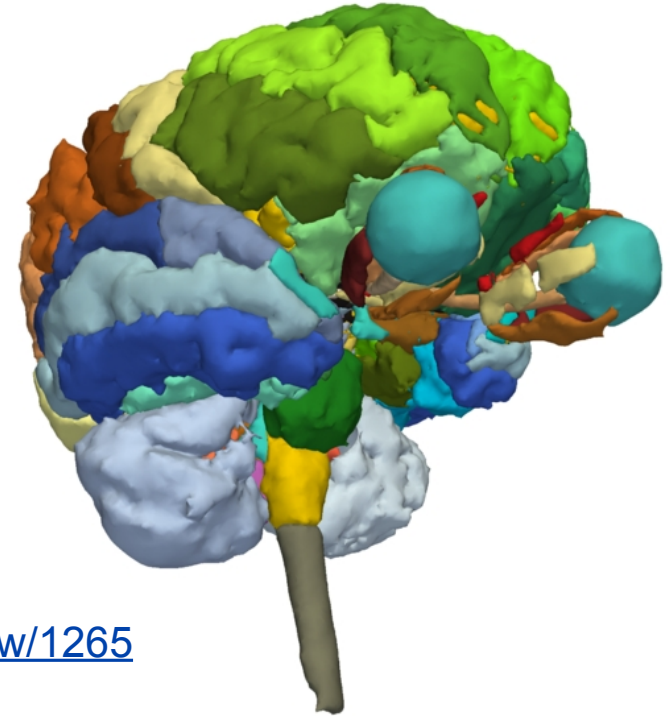


# Slicer3 Minute Tutorial

---

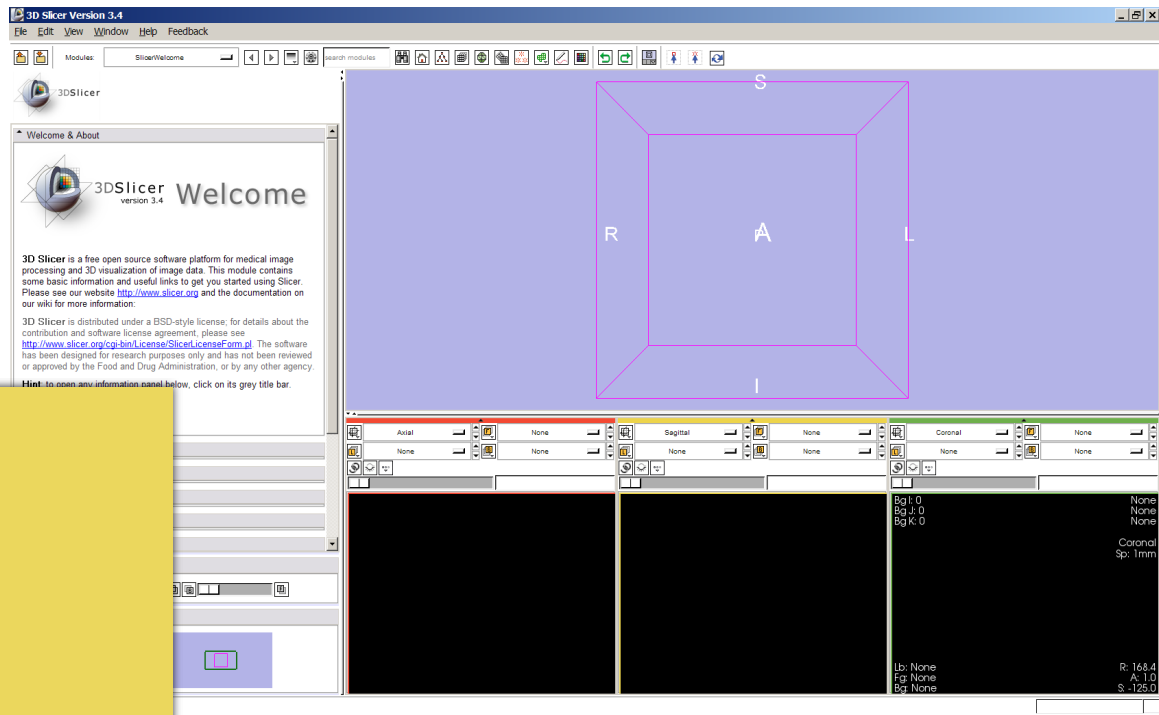
- The Slicer3minute dataset is composed of an MR scan of the brain and 3D surface reconstructions of anatomical structures.
- The data are part of the SPL-PNL Brain Atlas developed by Talos et al. The atlas is available at:

<http://www.spl.harvard.edu/publications/item/view/1265>





# Slicer3 Minute Tutorial: Launch the Application



## Windows users:

Double-Click the Shortcut to **Slicer3.exe** on the Desktop

or Select

**Start ->All Programs ->Slicer3 3.5.2009-11-06->Slicer**

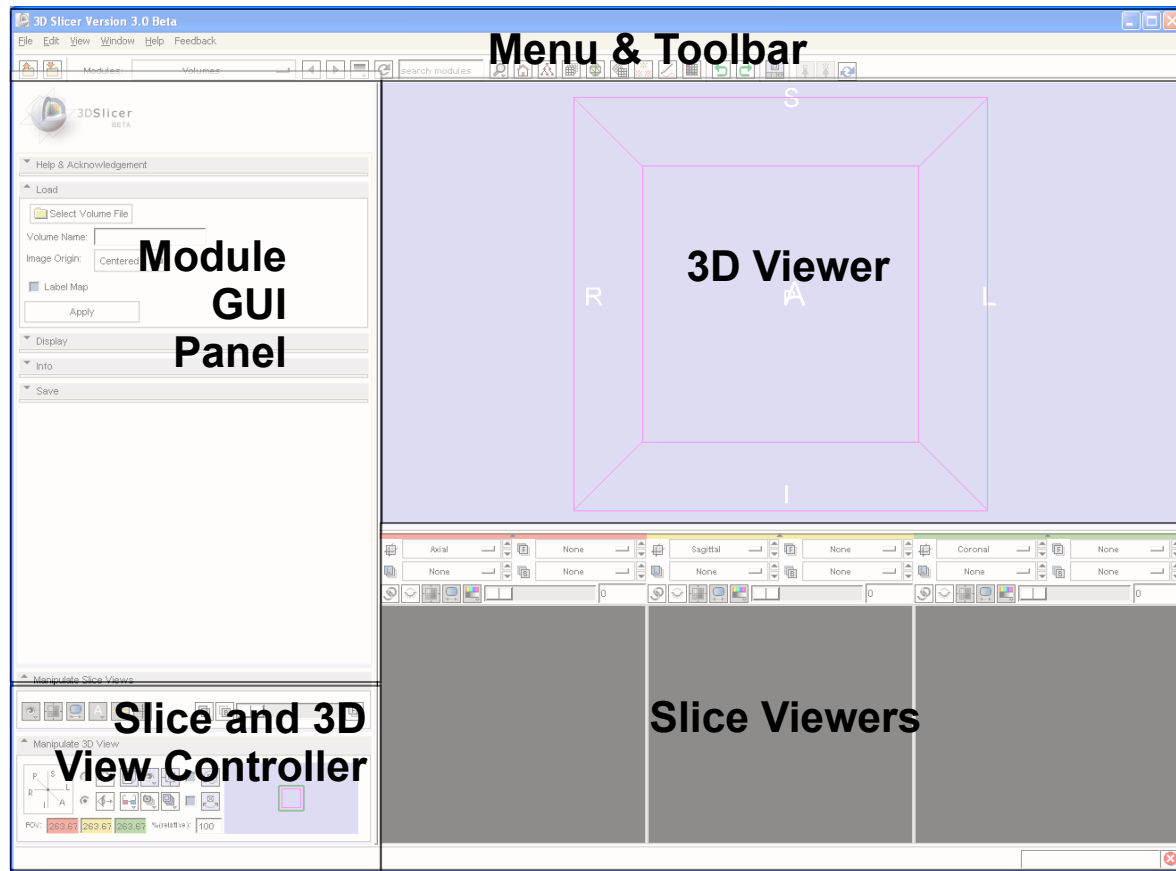




# Slicer3 Minute Tutorial: Navigating the Application GUI

The Graphical User Interface (GUI) of Slicer3 integrates **five components**:

- the Menu Toolbar
- the Module GUI Panel
- the 3D Viewer
- the Slice Viewer
- the Slice and 3D View Controller

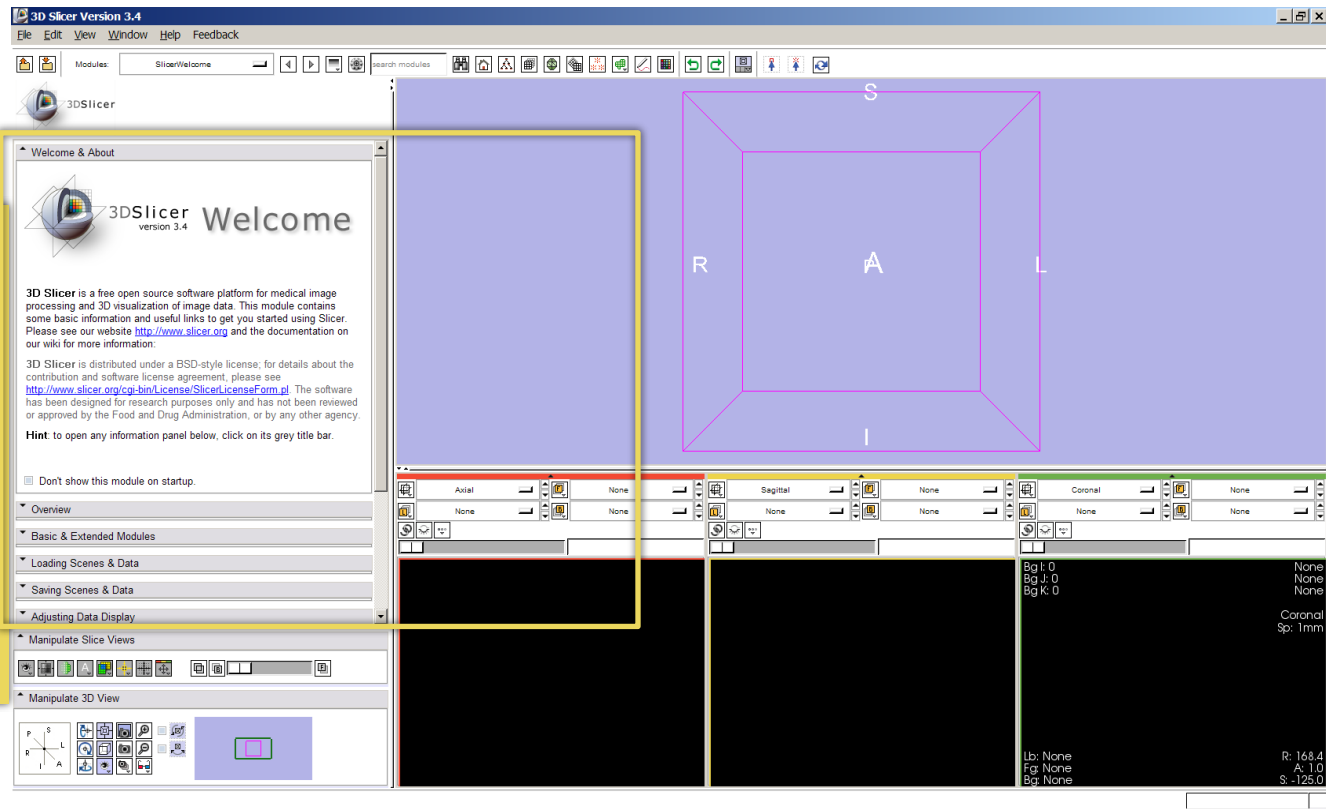




# Slicer3 Minute Tutorial: Welcome Module

The **SlicerWelcome** module is the module displayed by default.

This module gives an overview of the GUI of Slicer3, and **data loading & saving functionalities**.

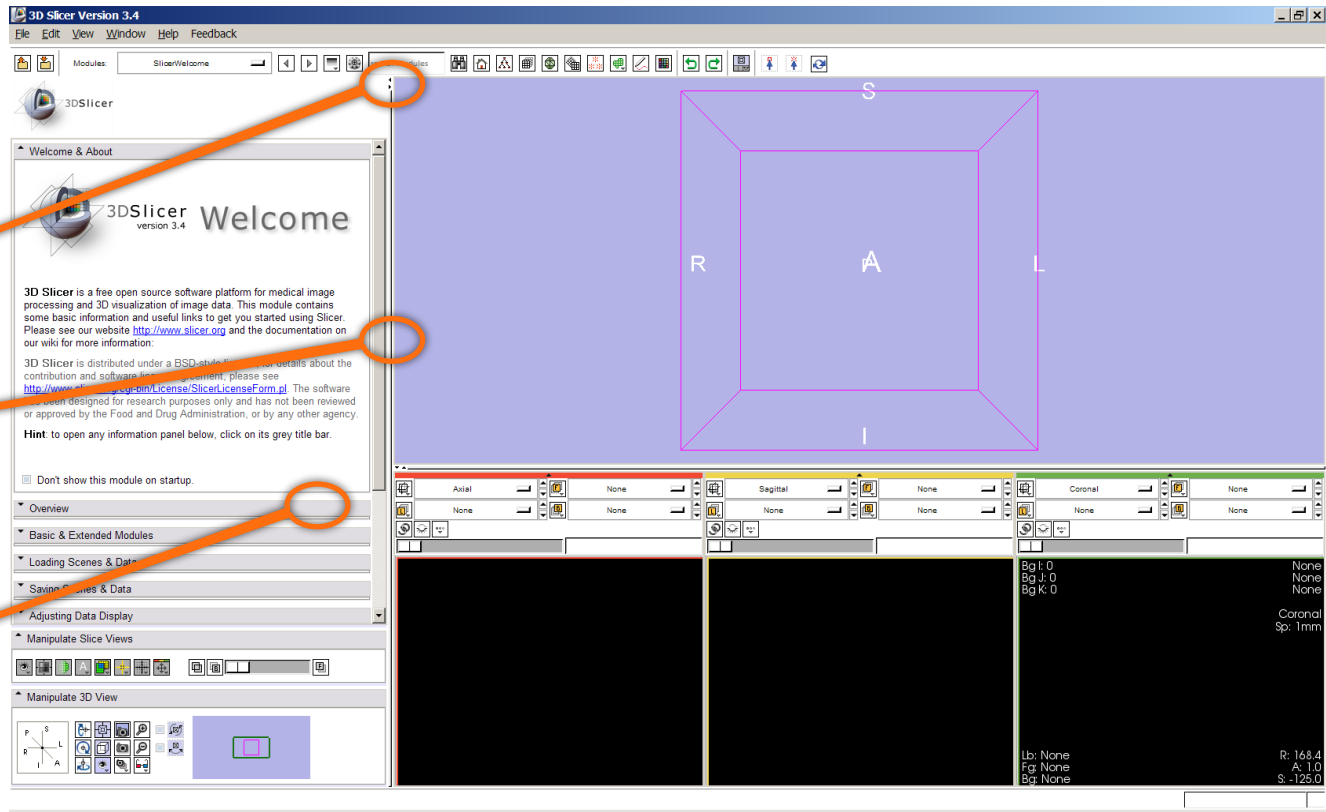




# Slicer3 Minute Tutorial: GUI Basics

Expand or shrink the GUI panel with the arrows at the frame top, or by clicking and dragging the vertical separator

Expand or collapse any sub-panel by clicking on its grey title bar





3DSlicer

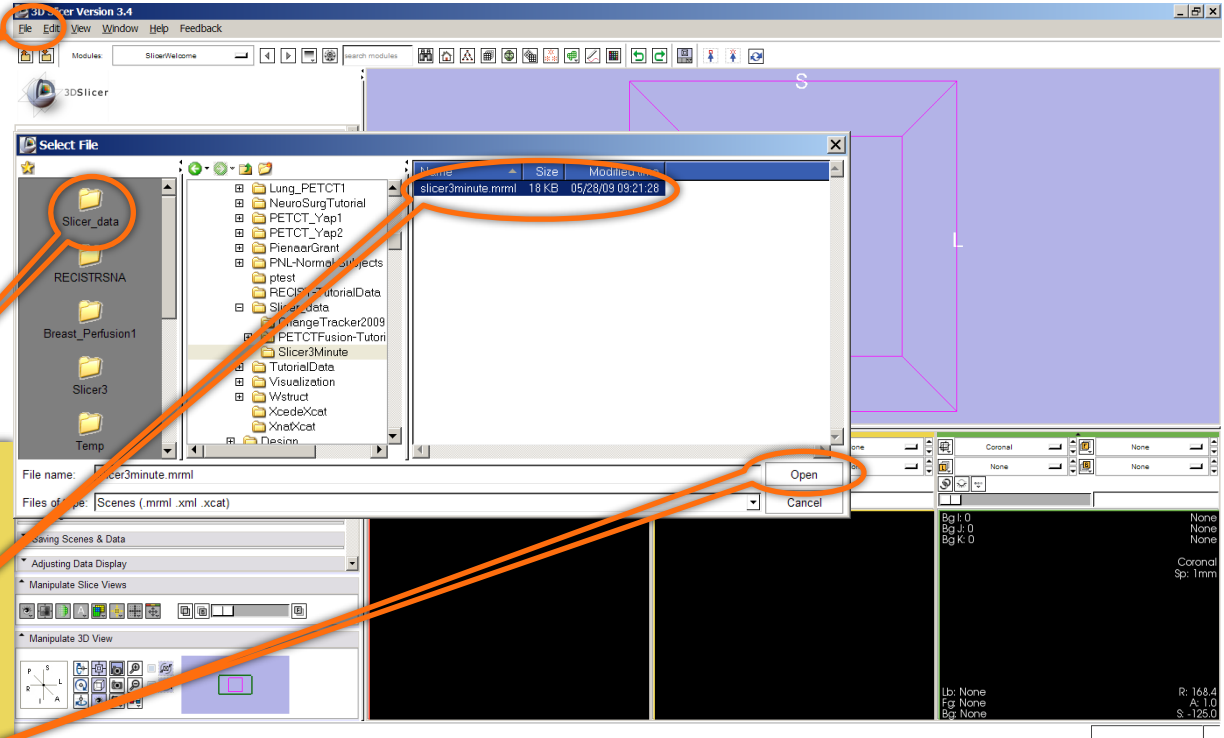
# Slicer3 Minute Tutorial: Load A Scene

Select File-> Load Scene from the File menu

Browse to the location of the Slicer3MinuteDataset directory.

Select the scene file slicer3minute.mrml

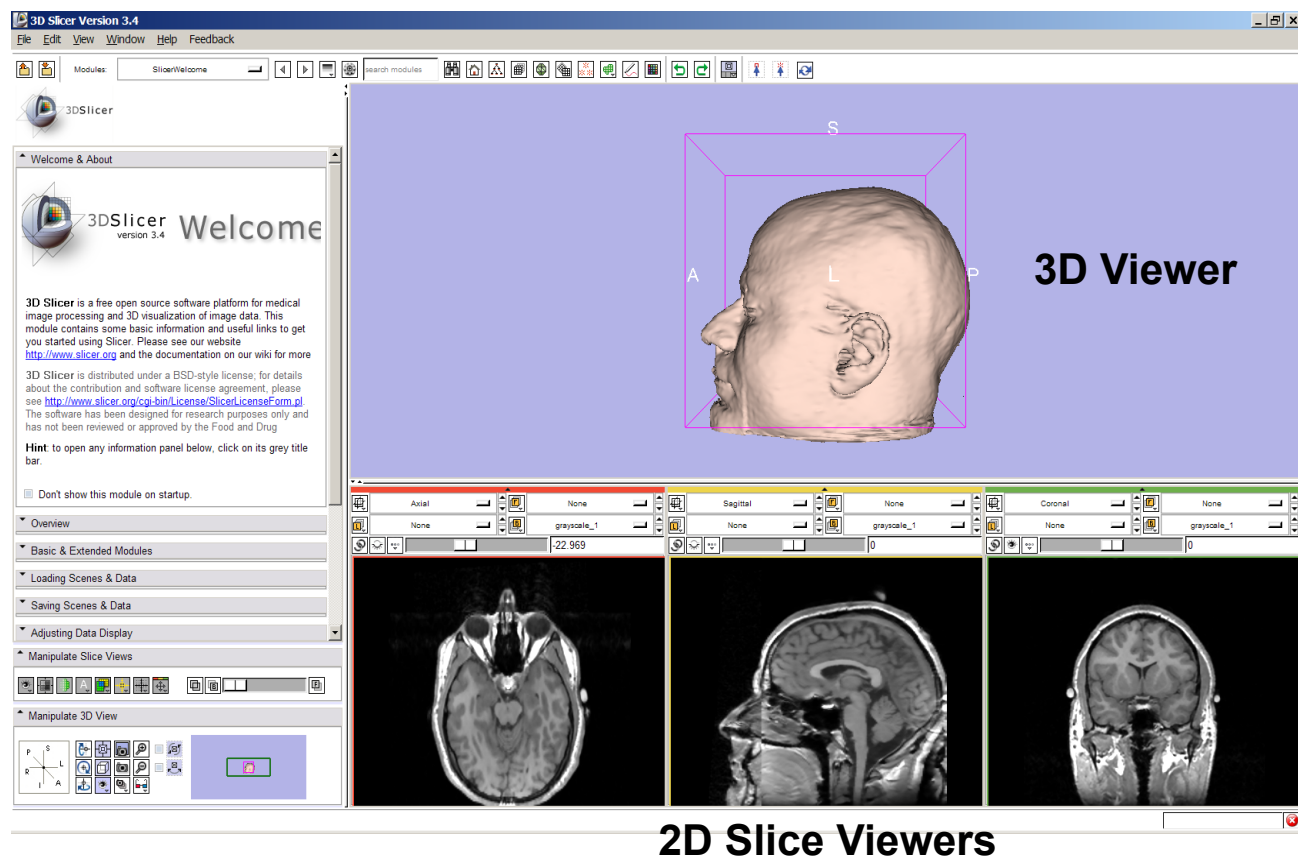
Click on Open to load the scene





# Slicer3 Minute Tutorial: Viewing the Scene

Slicer displays a 3D model of the head in the 3D Viewer, and anatomical MR slices of the brain in the 2D Slice Viewer.

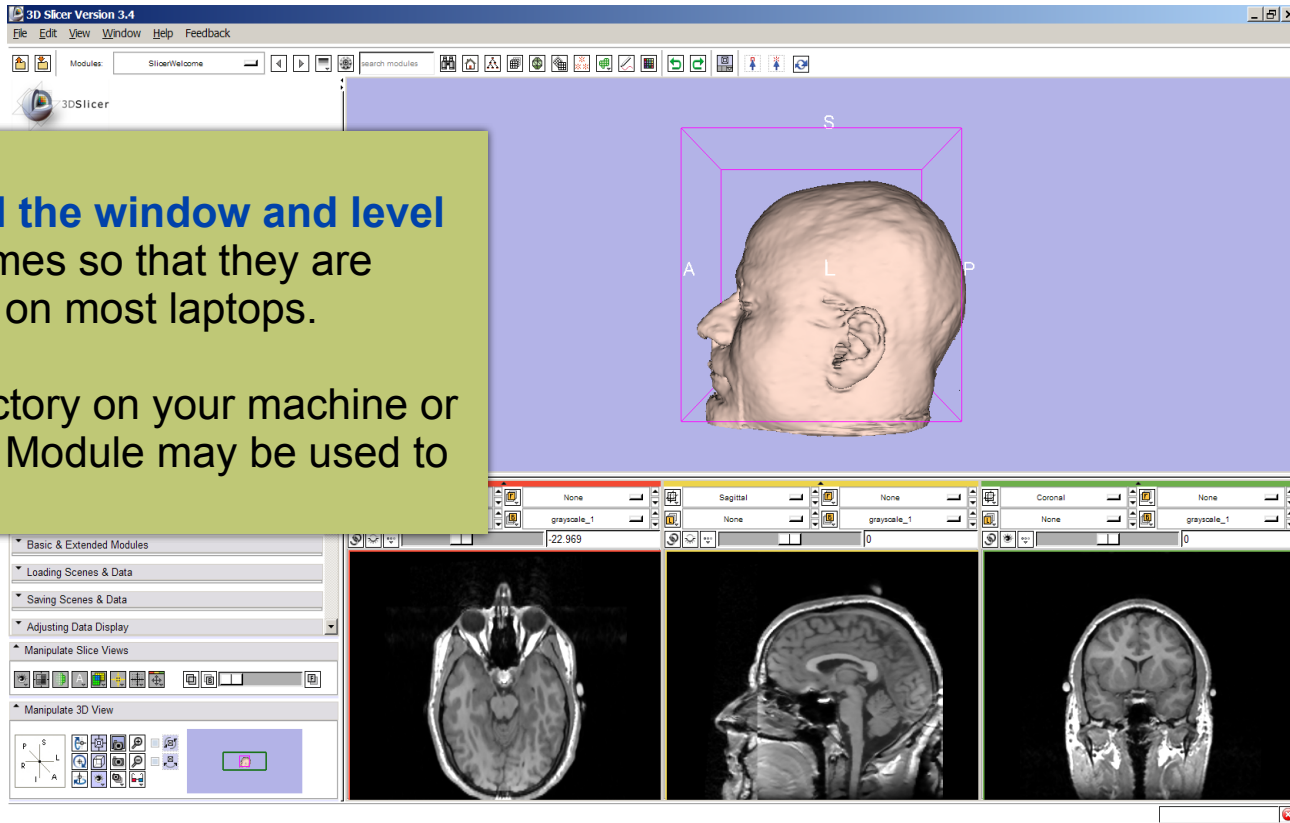




# Slicer3 Minute Tutorial: Viewing the Scene

Please note:  
We have **pre-adjusted the window and level** settings for these volumes so that they are appropriate for display on most laptops.

If display is not satisfactory on your machine or projector, the Volumes Module may be used to refine these settings.

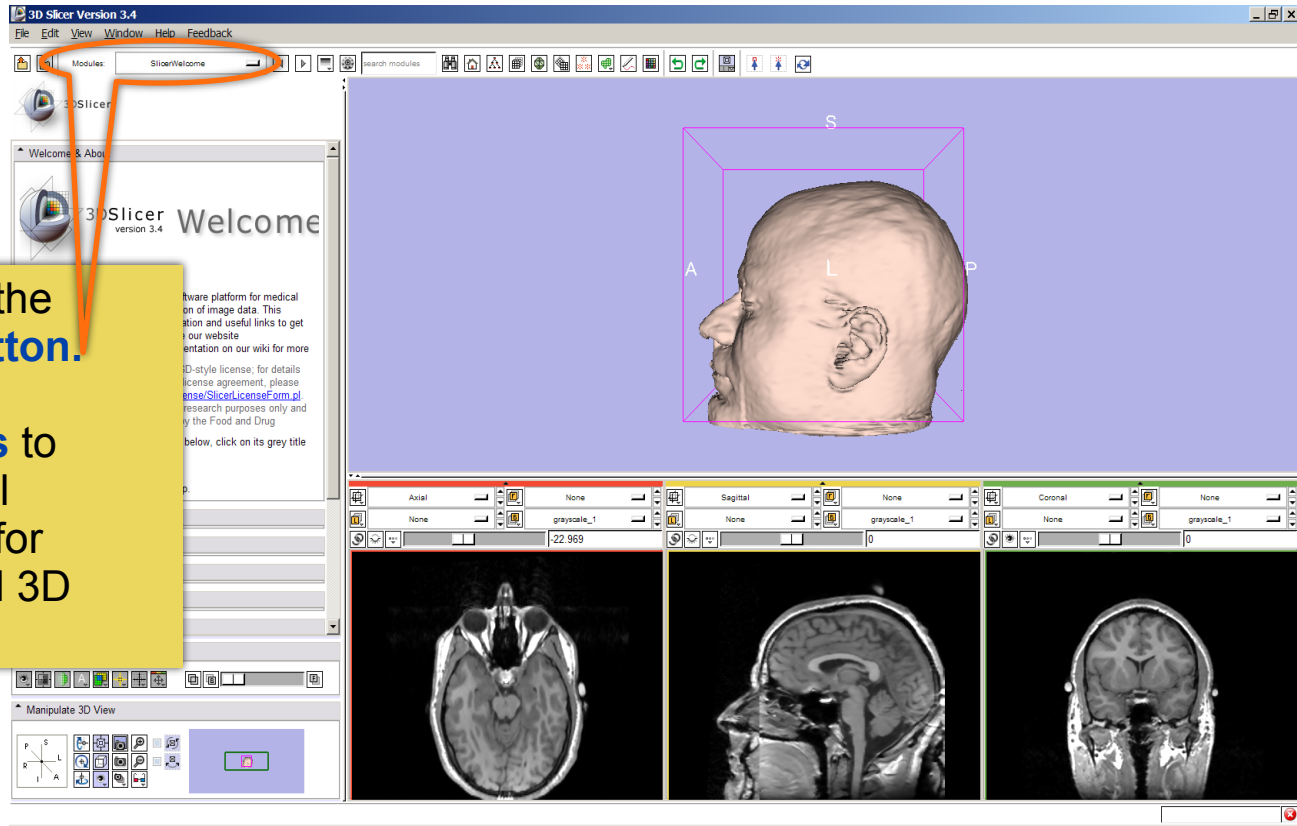




# Slicer3 Minute Tutorial: Exploring Slicer's functionality

Left click and hold the **Modules** menubutton.

Select **All Modules** to display the list of all modules available for image analysis and 3D visualization.





# Slicer3 Minute Tutorial: Exploring Slicer's functionality

3DSlicer

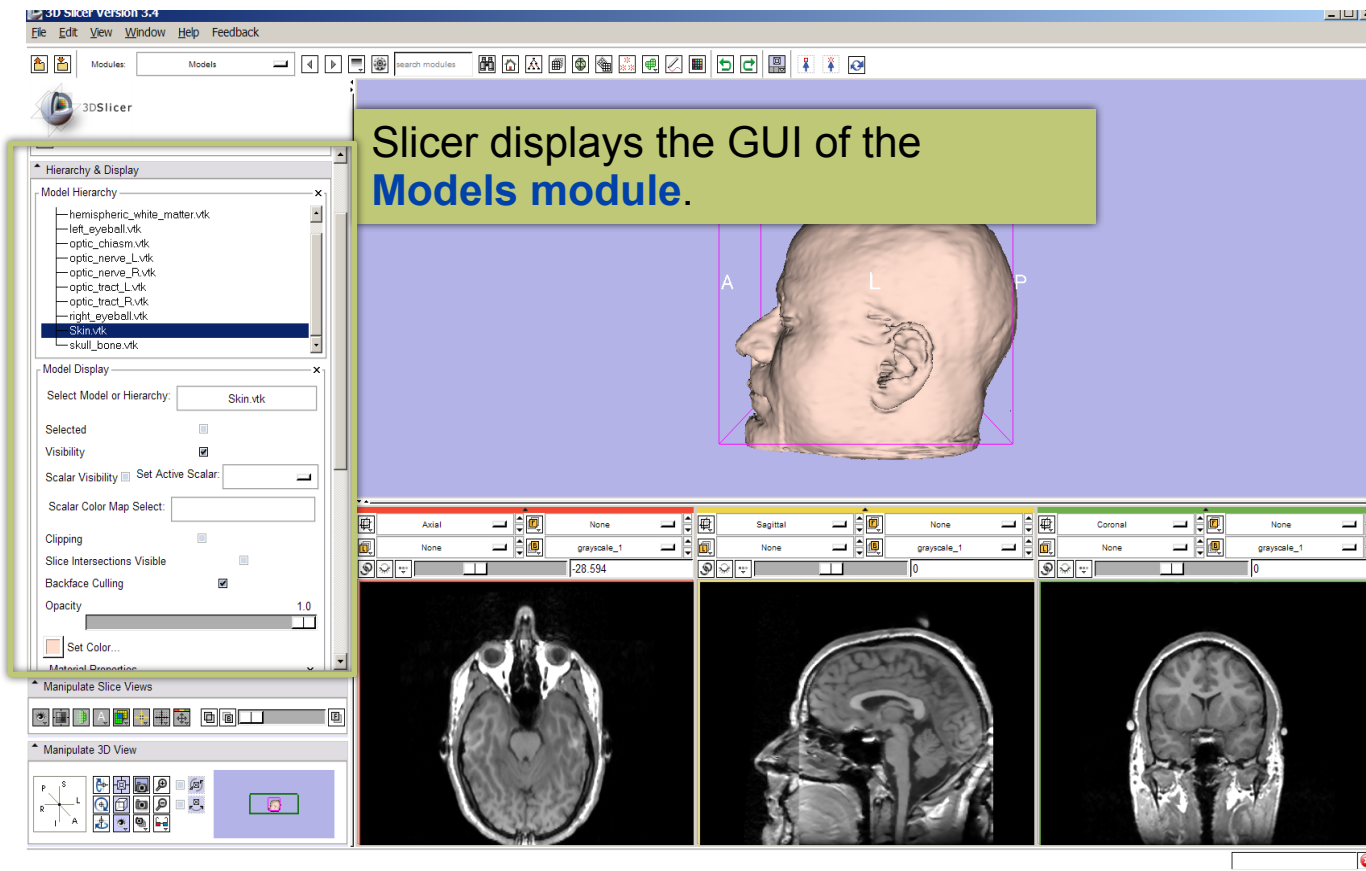
To access the Models module, browse through the list of modules or click on the shortcut icon in the toolbar

The screenshot shows the Slicer3.5 Alpha interface. The 'Modules' menu is open, and the 'Models' module is highlighted with a red circle. An orange arrow points from the 'Models' module in the menu to a yellow callout box. The 'Models' module is also visible in the 'All Modules' list on the right side of the interface. The interface includes a menu bar (File, Edit, View, Window, Help), a toolbar with various icons, a 'Hierarchy & Display' panel on the left, and a main 3D view area at the bottom showing three different views of a brain MRI scan.





# Slicer3 Minute Tutorial: Switching to the Models Module

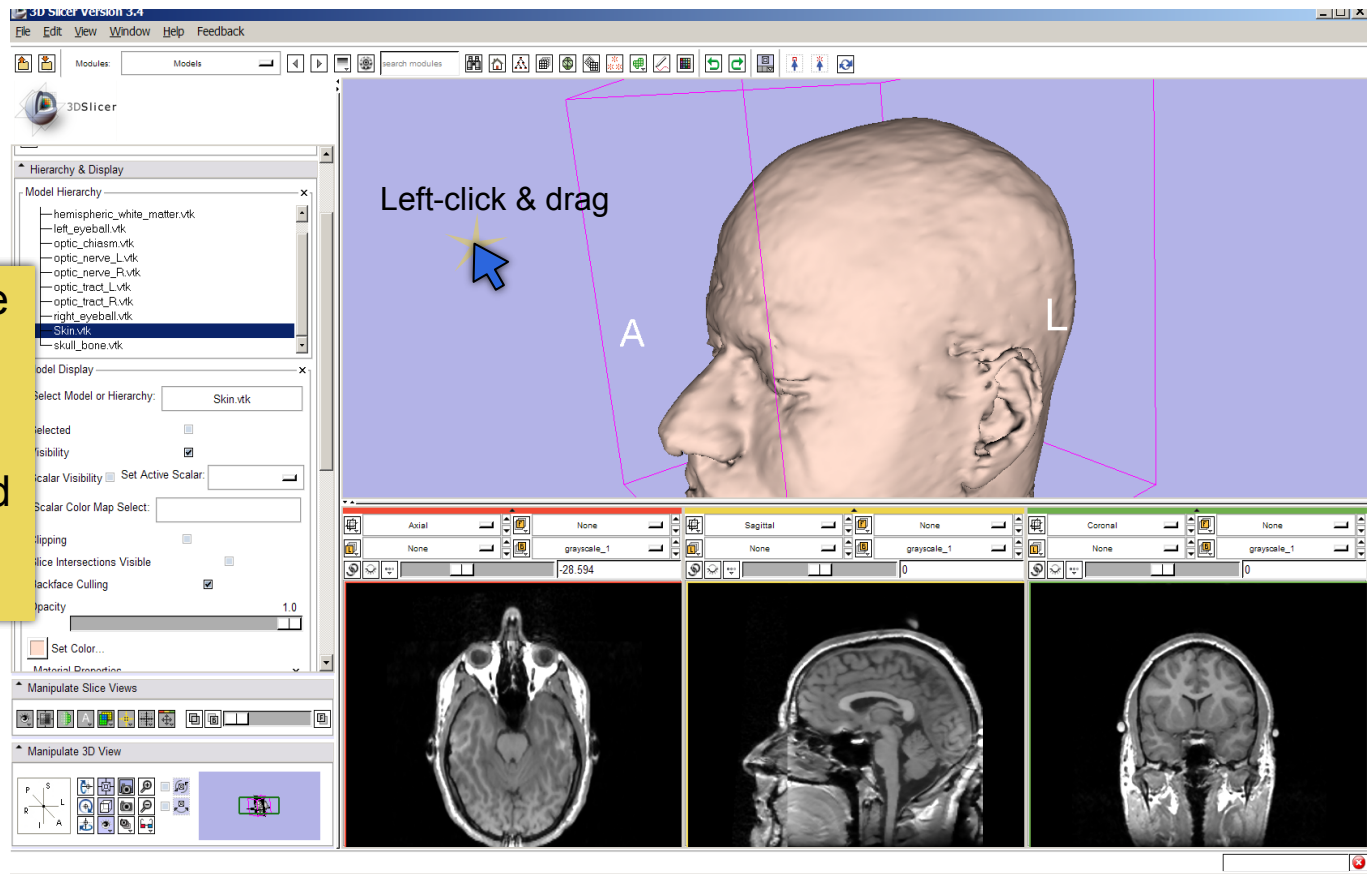




# Slicer3 Minute Tutorial: Basic 3D Interaction

Position the mouse in the 3D Viewer.

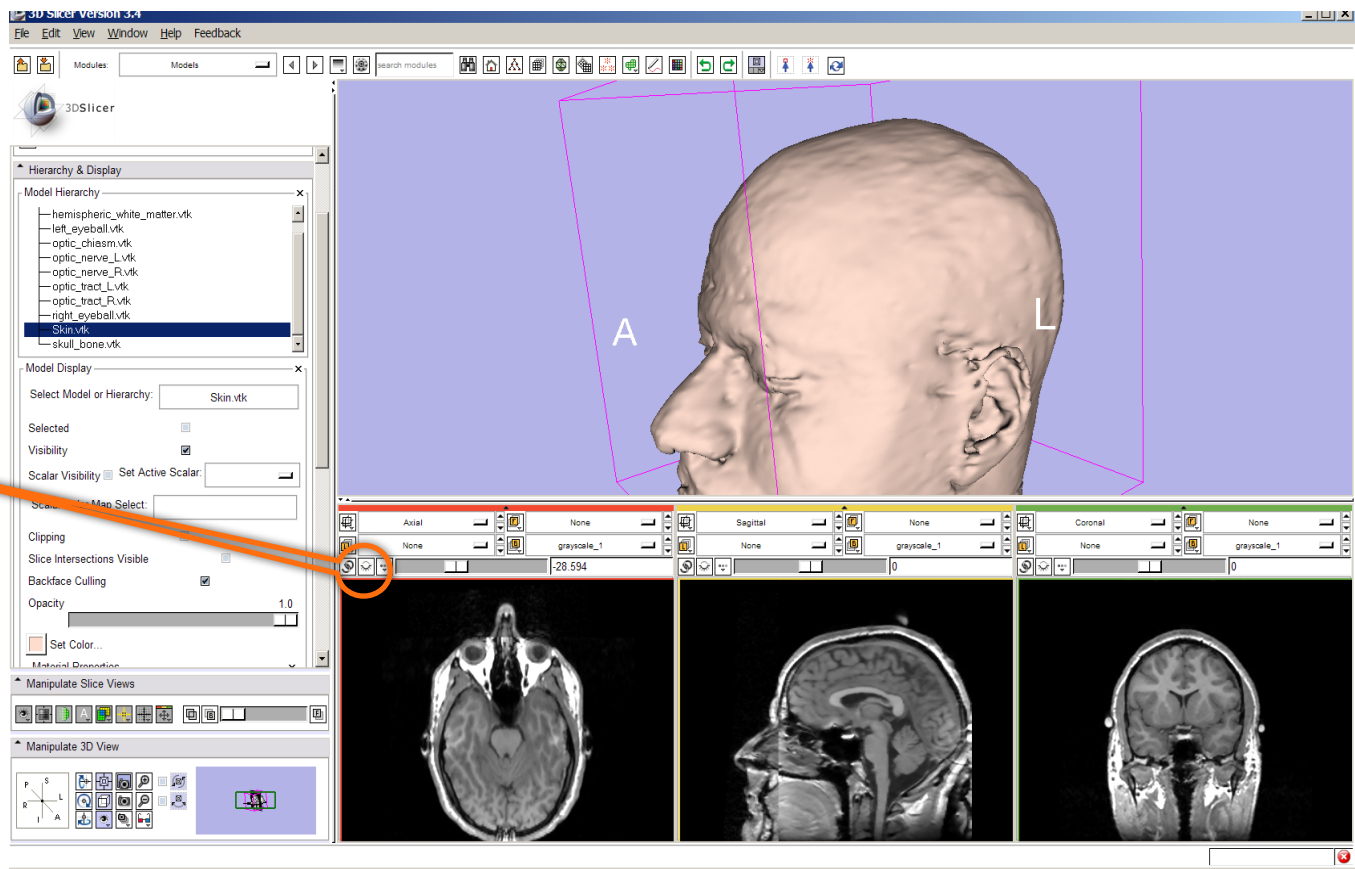
Hold down the **left mouse button** and **drag to rotate** the model.





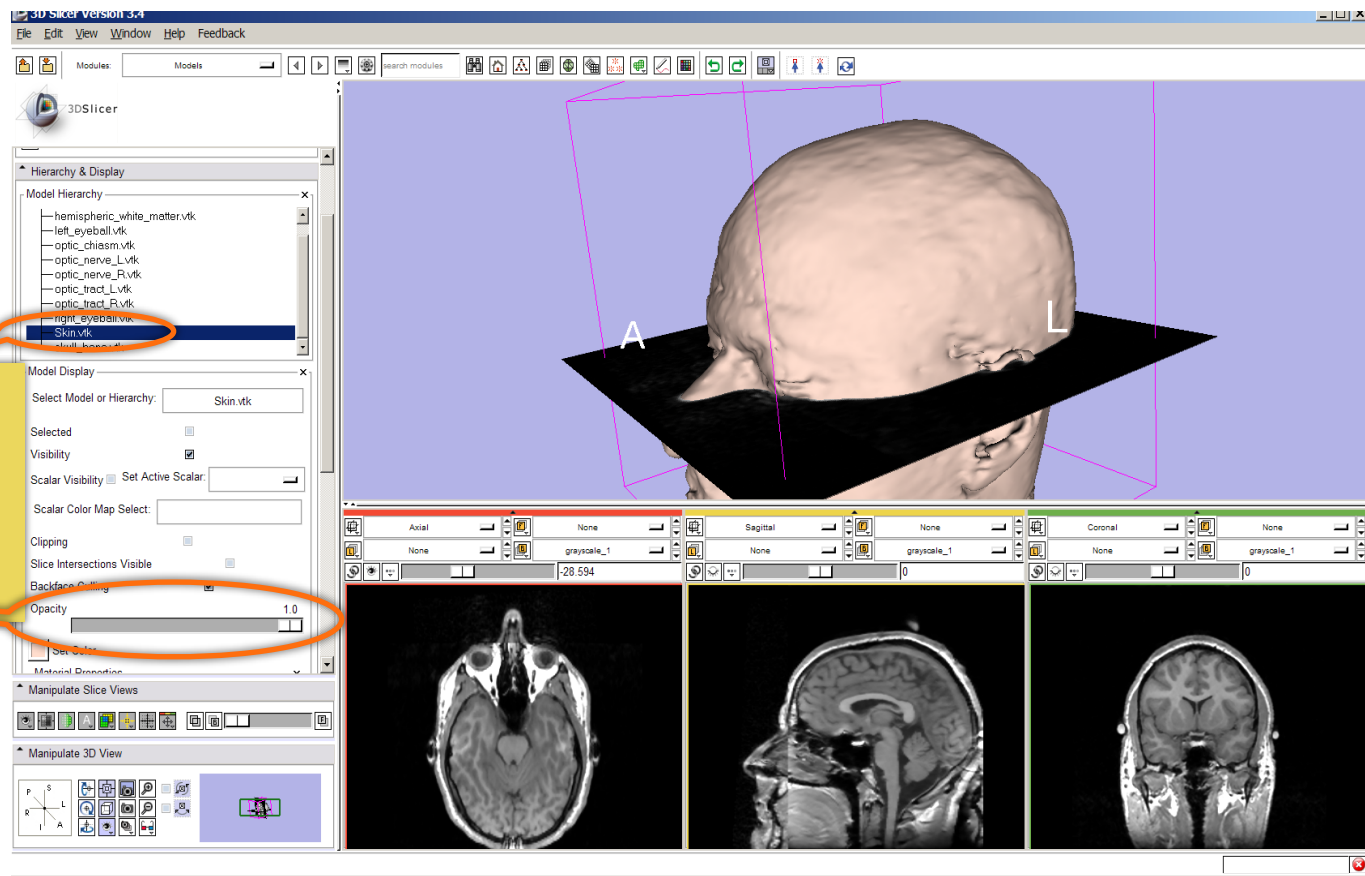
# Slicer3 Minute Tutorial: Viewing Slices in the 3D Viewer

Click on the **Slice Visibility** icon to display the Axial Slice in the 3D Viewer





# Slicer3 Minute Tutorial: 3D Visualization

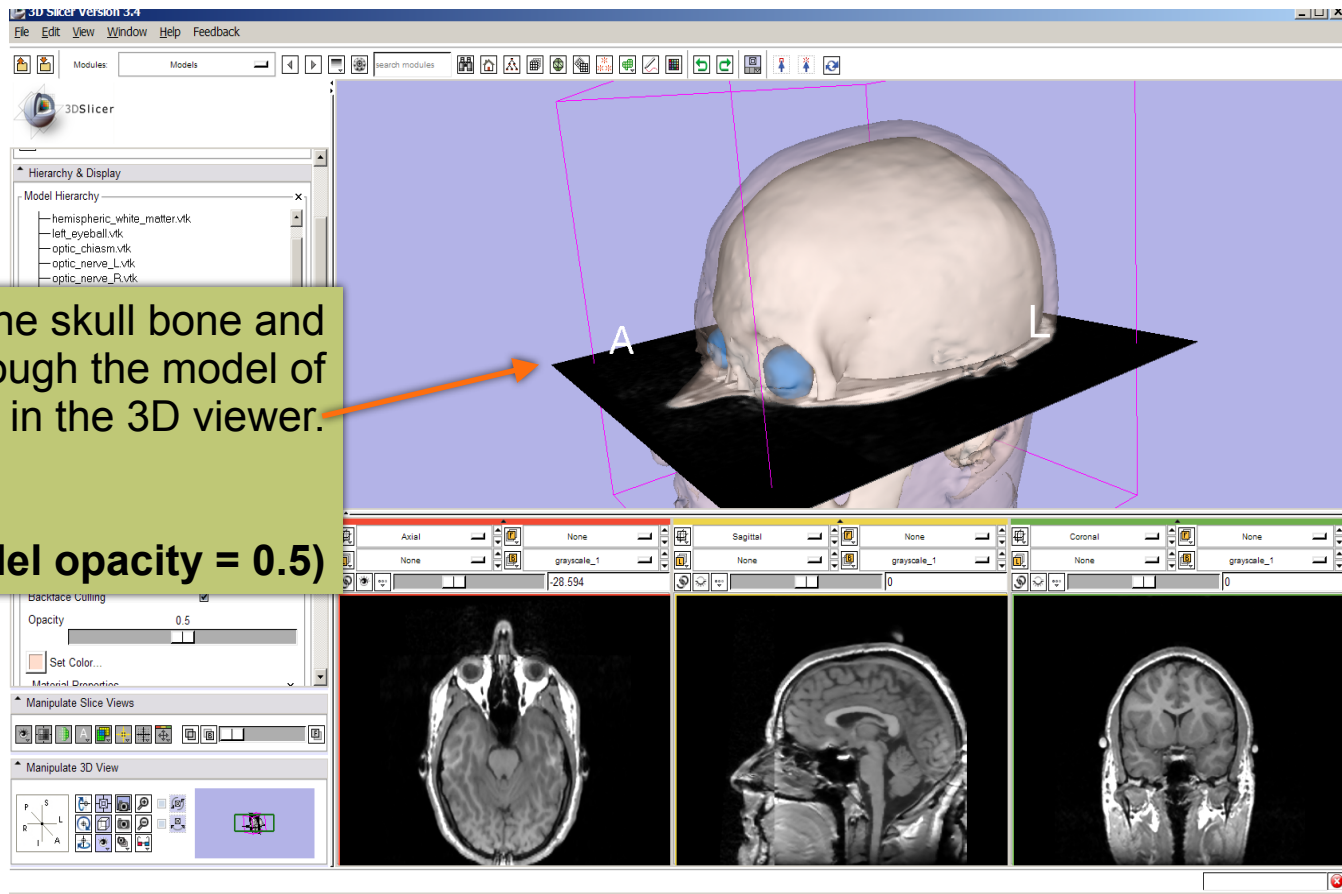


Select the **Skin model**.

Change the opacity of the model from **1.0 to 0.0**.



# Slicer3 Minute Tutorial: 3D Visualization



The model of the skull bone and eyeballs appear through the model of the skin in the 3D viewer.

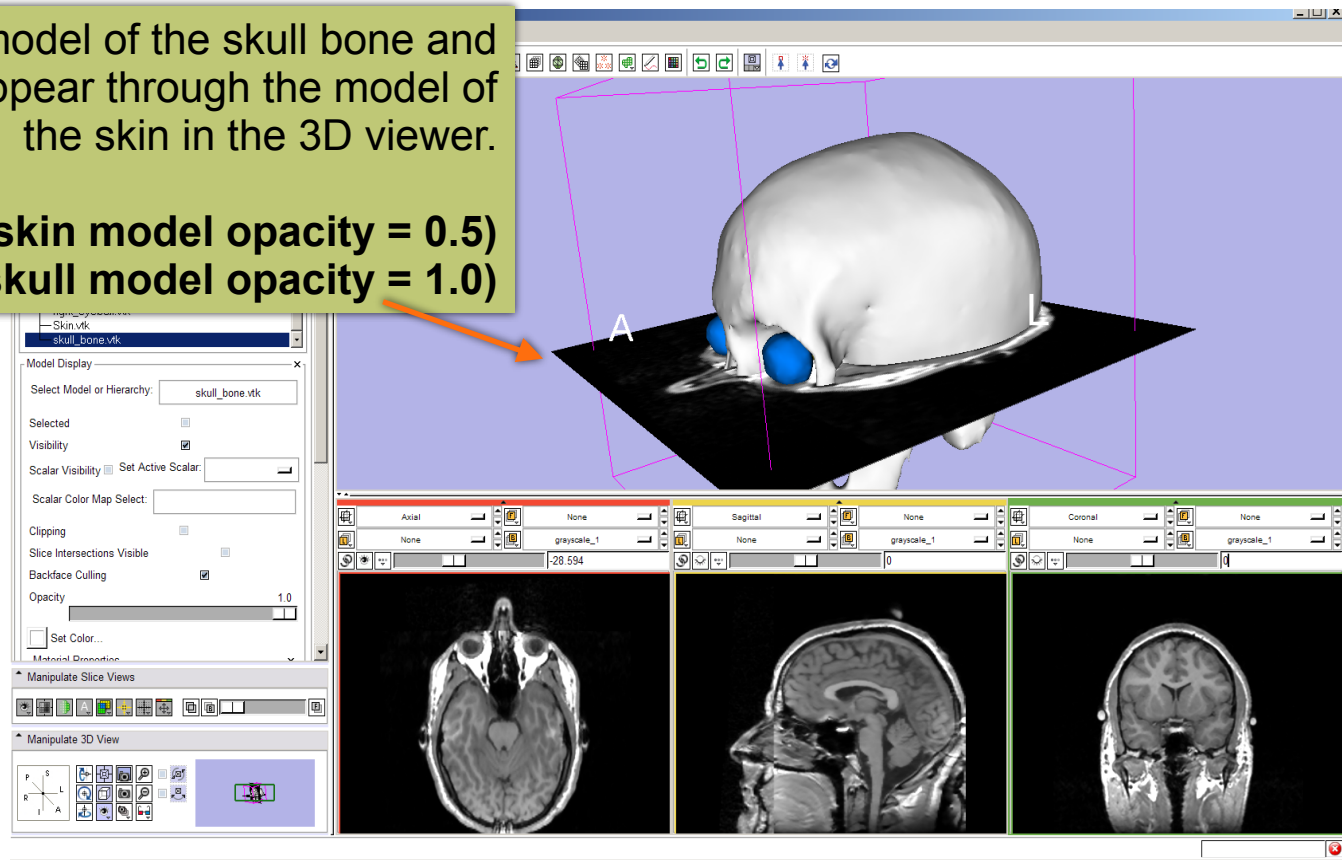
(skin model opacity = 0.5)



# Slicer3 Minute Tutorial: 3D Visualization

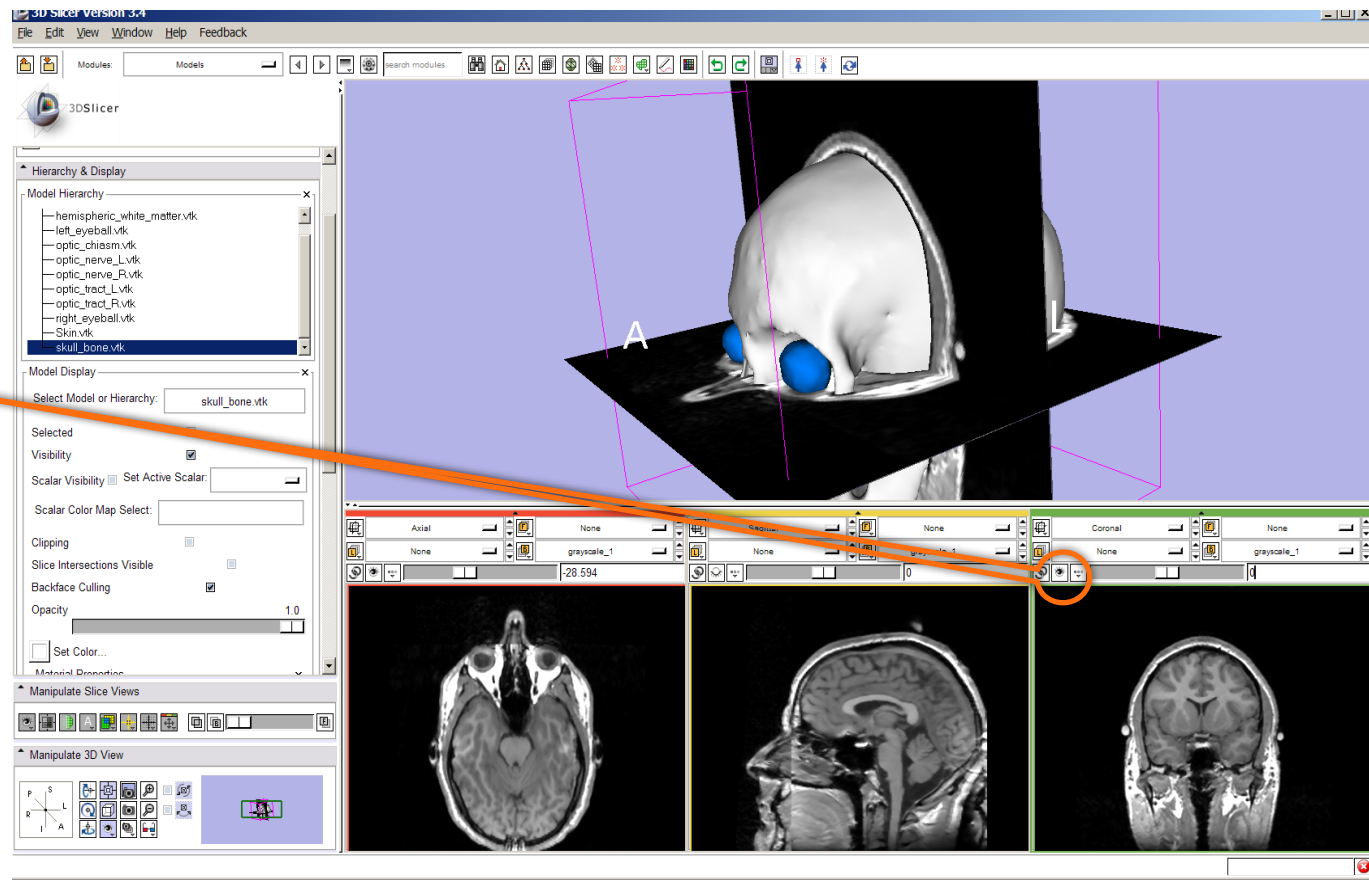
The model of the skull bone and eyeballs appear through the model of the skin in the 3D viewer.

**(skin model opacity = 0.5)**  
**(skull model opacity = 1.0)**





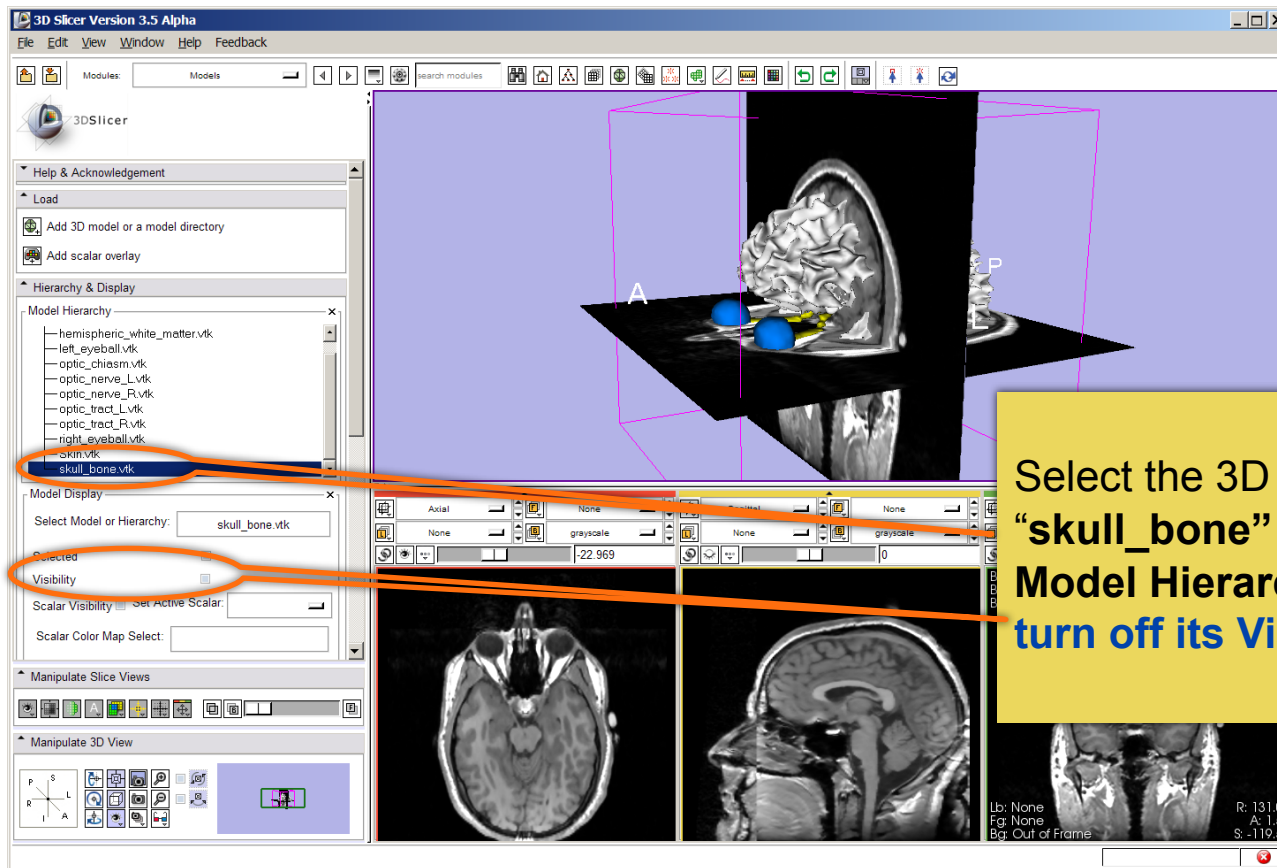
# Slicer3 Minute Tutorial: 3D Visualization



Click on the **Slice Visibility** icon in the **Green Slice Viewer** to display the Coronal Slice in the 3D Viewer



# Slicer3 Minute Tutorial: 3D Visualization

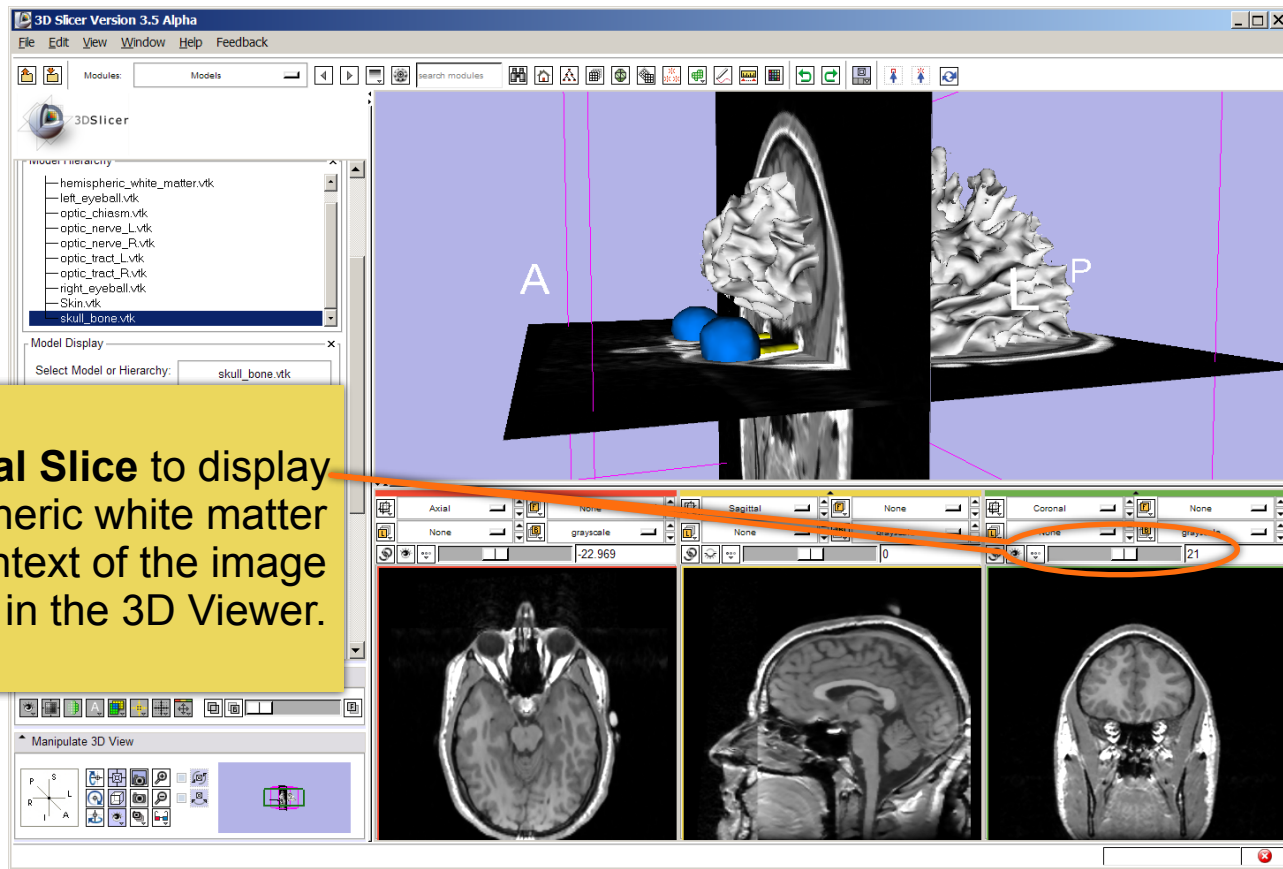


Select the 3D model “skull\_bone” in the Model Hierarchy, and turn off its Visibility





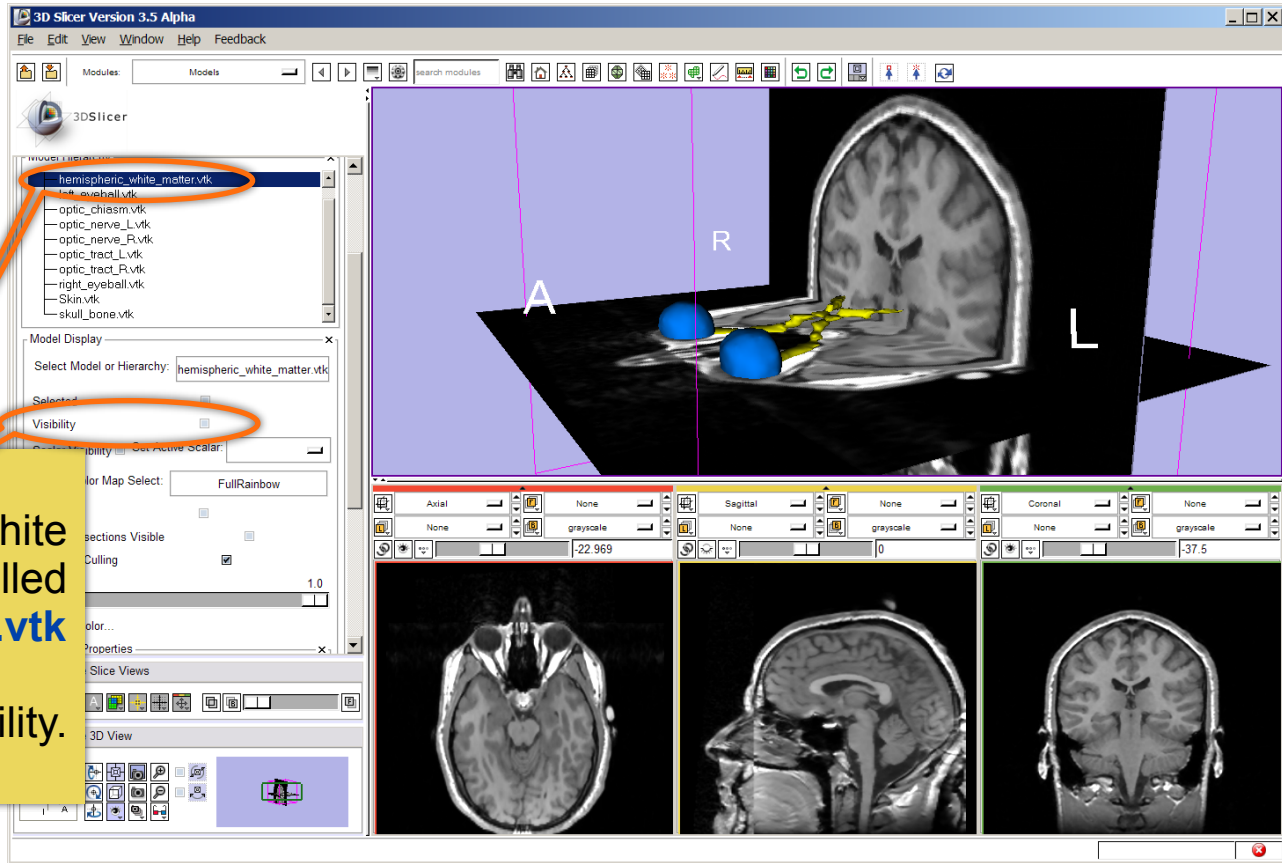
# Slicer3 Minute Tutorial: 3D Visualization



Scroll the **Coronal Slice** to display the hemispheric white matter model in the context of the image data in the 3D Viewer.



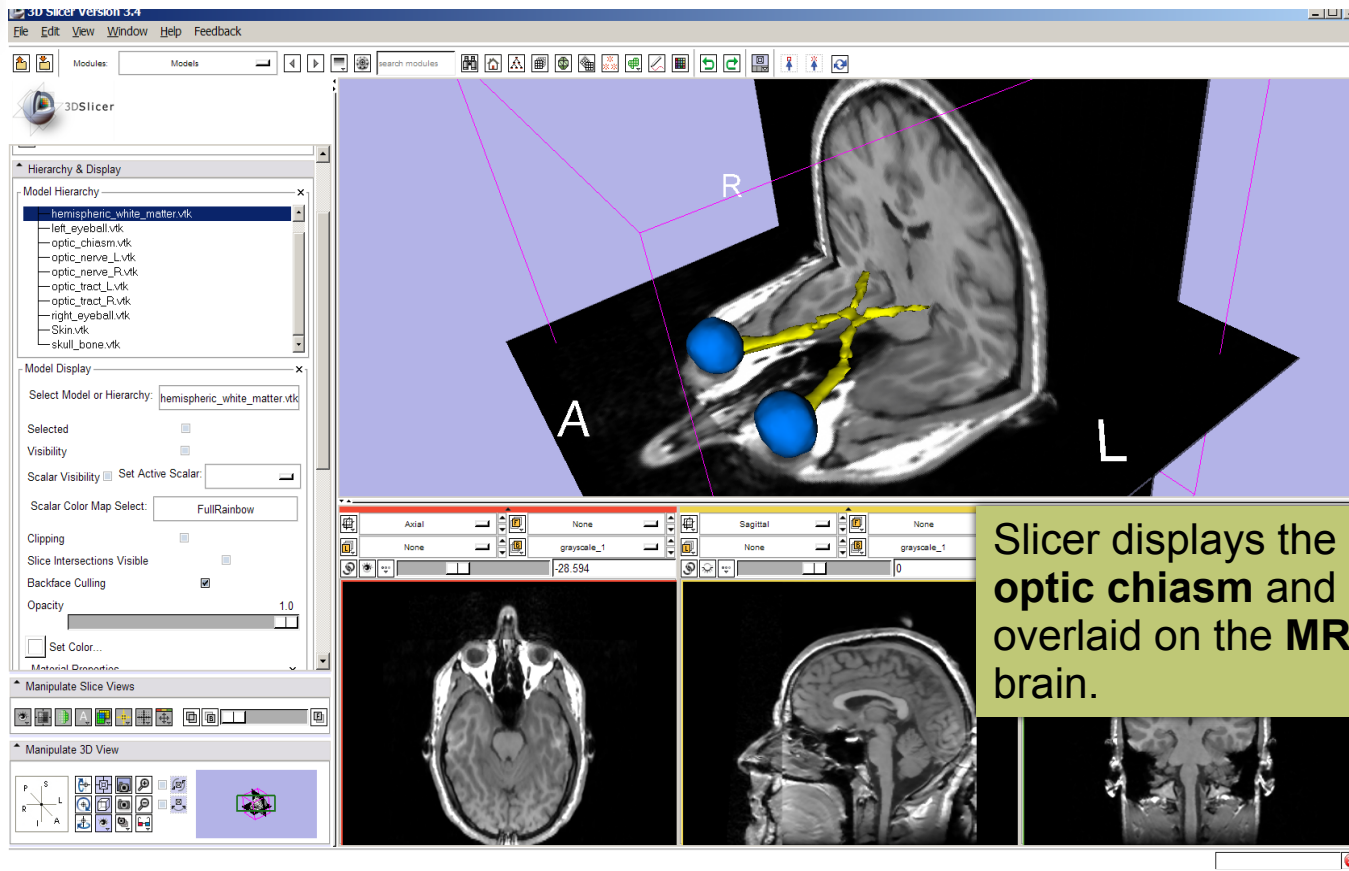
# Slicer3 Minute Tutorial: 3D Visualization



Select the hemispheric white matter model called **hemispheric\_white\_matter.vtk**  
Turn off its visibility.



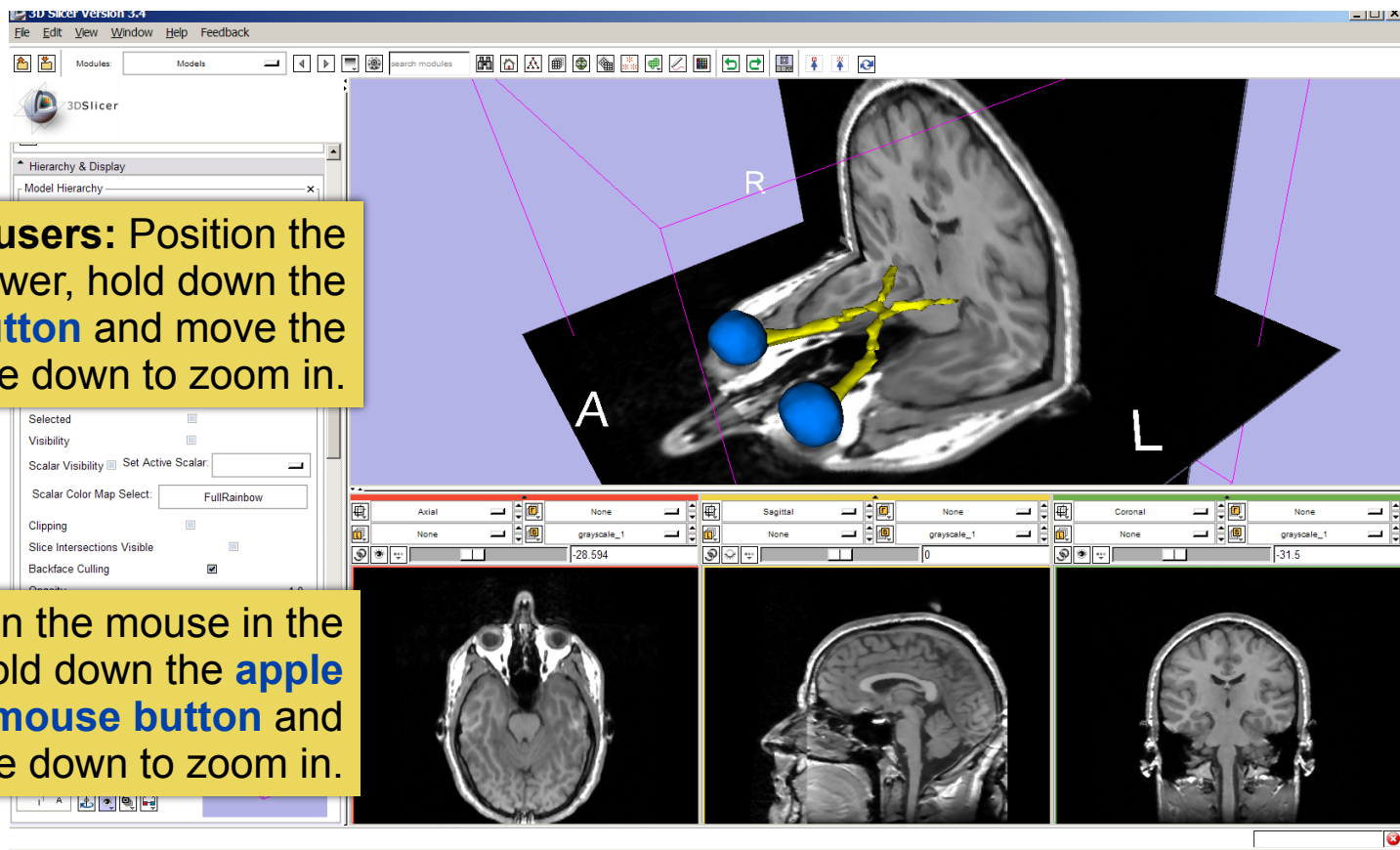
# Slicer3 Minute Tutorial: 3D Visualization



Slicer displays the optic nerve, optic chiasm and optic tracts overlaid on the MR images of the brain.



# Slicer3 Minute Tutorial: 3D Visualization

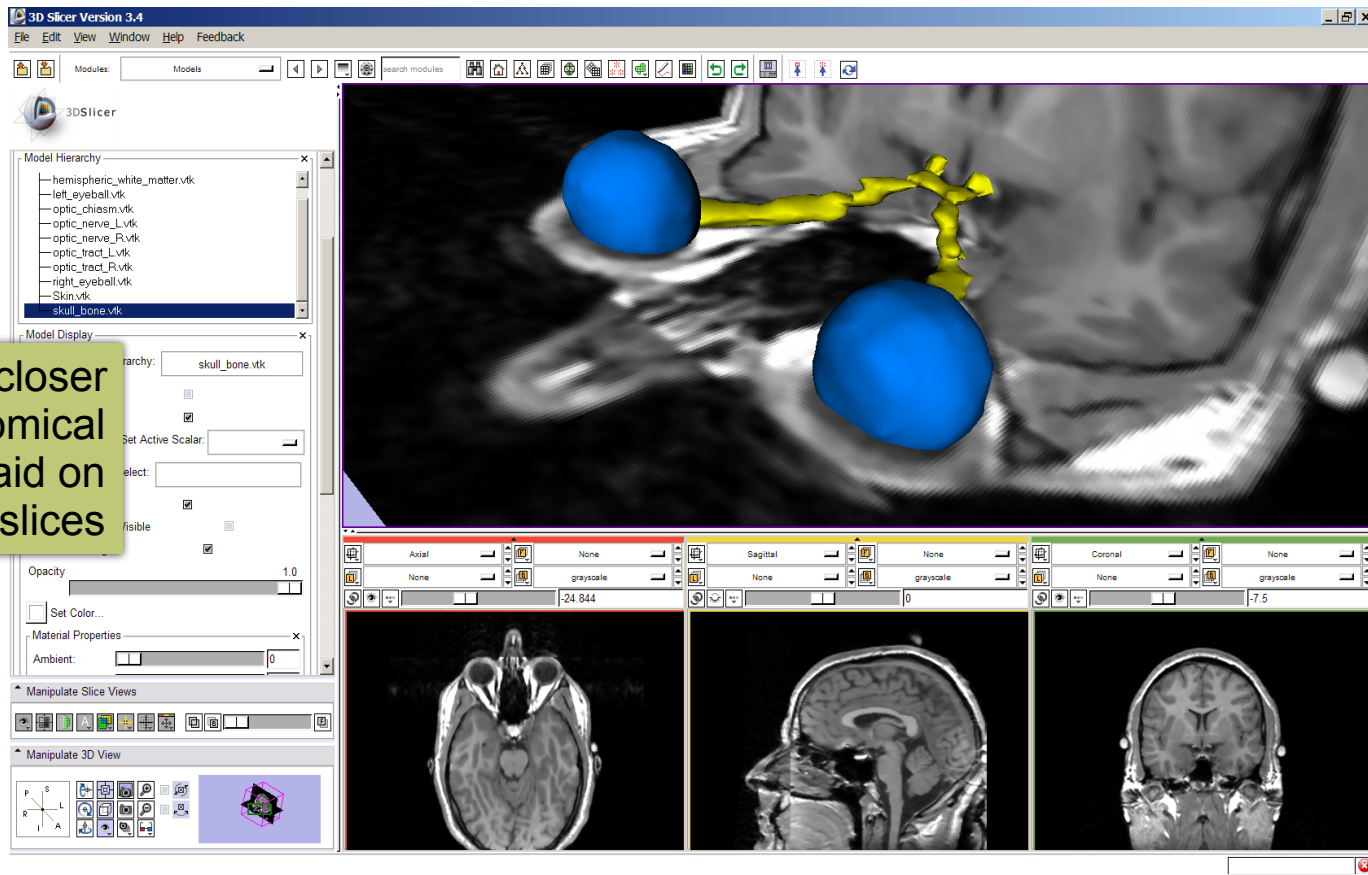


**Windows/Linux users:** Position the mouse in the 3D Viewer, hold down the **right mouse button** and move the mouse down to zoom in.

**Mac users:** Position the mouse in the 3D Viewer, hold down the **apple button and the mouse button** and move the mouse down to zoom in.



# Slicer3 Minute Tutorial: 3D Visualization



Slicer3 displays a closer view of 3D anatomical structures overlaid on 2D MR slices



## Slicer3 Minute Tutorial: **Summary**

---

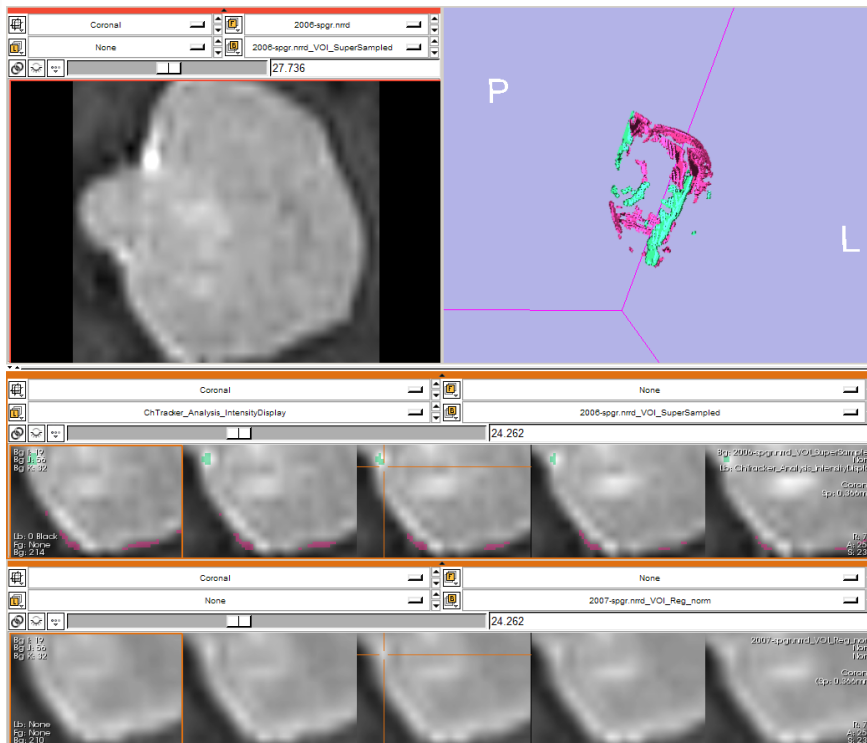
This tutorial has demonstrated:

- Basic description of the Slicer3 Application Interface
- How to load a scene containing volumes and models
- How to visualize these different datasets together

Next, we will use these building blocks to perform image analysis and visualize quantitative results.



# ChangeTracker: exploring small volumetric changes



## *Part II: Analyzing Small Volumetric Changes using the ChangeTracker Module*

Kilian M Pohl, PhD  
Ender Konugolu, PhD  
Andriy Fedorov, PhD

The module described in this tutorial was tested on Axial 3D SPGR T1 post Gadolinium scans (Voxel dimension: 0.94mm x 0.94mm x 1.20mm, FOV: 240mm, Matrix: 256 x 256)



## ChangeTracker: Conventional measures of tumor response

---

- Conventional anatomic imaging using CT or MRI are often used to evaluate tumor size and shape
- Most clinical trials that evaluate new chemotherapeutic drugs use changes in uni-dimensional or bi-dimensional measurements to assess response (e.g. RECIST)
- Slicer has several tools for applying RECIST methodologies

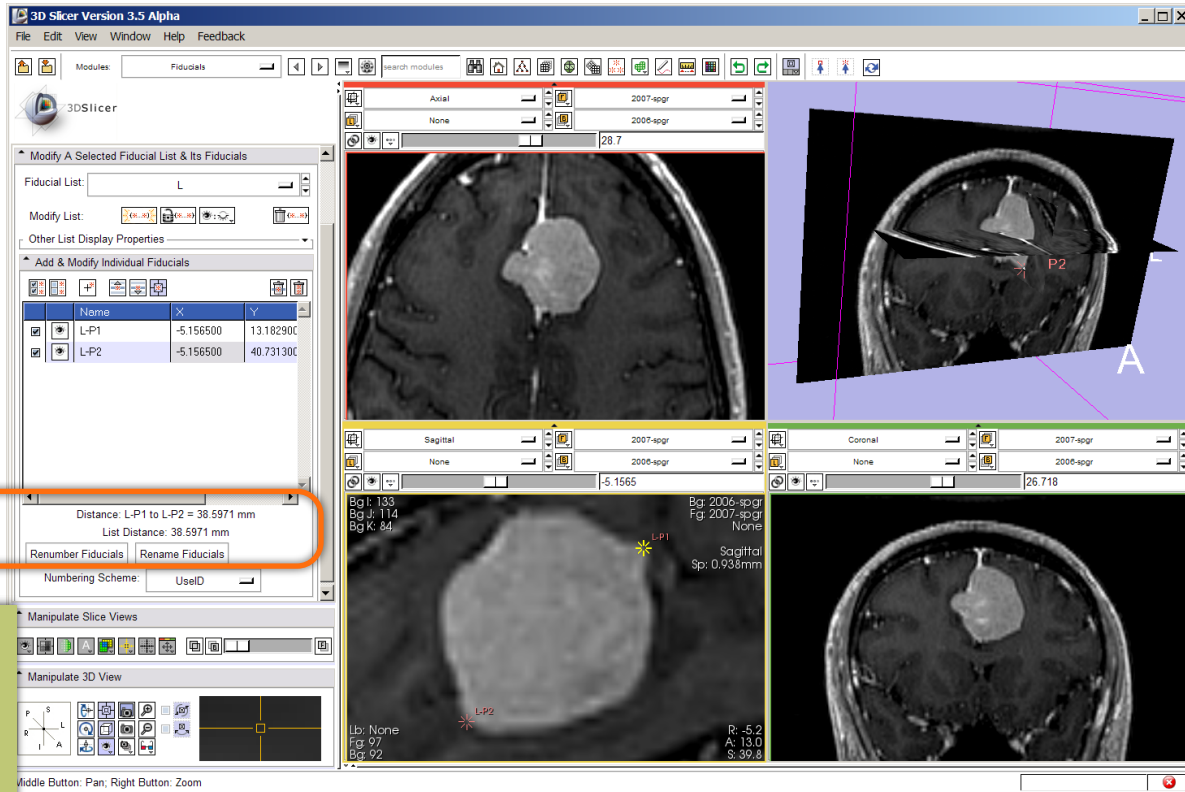




# Quantifying tumor change: Conventional measures of tumor response

3D Slicer's **Fiducials Module** can be used to measure the **longest diameter** in a tumor cross section.

The **distance measurement** (mm) will be updated in the Fiducial's GUI panel.

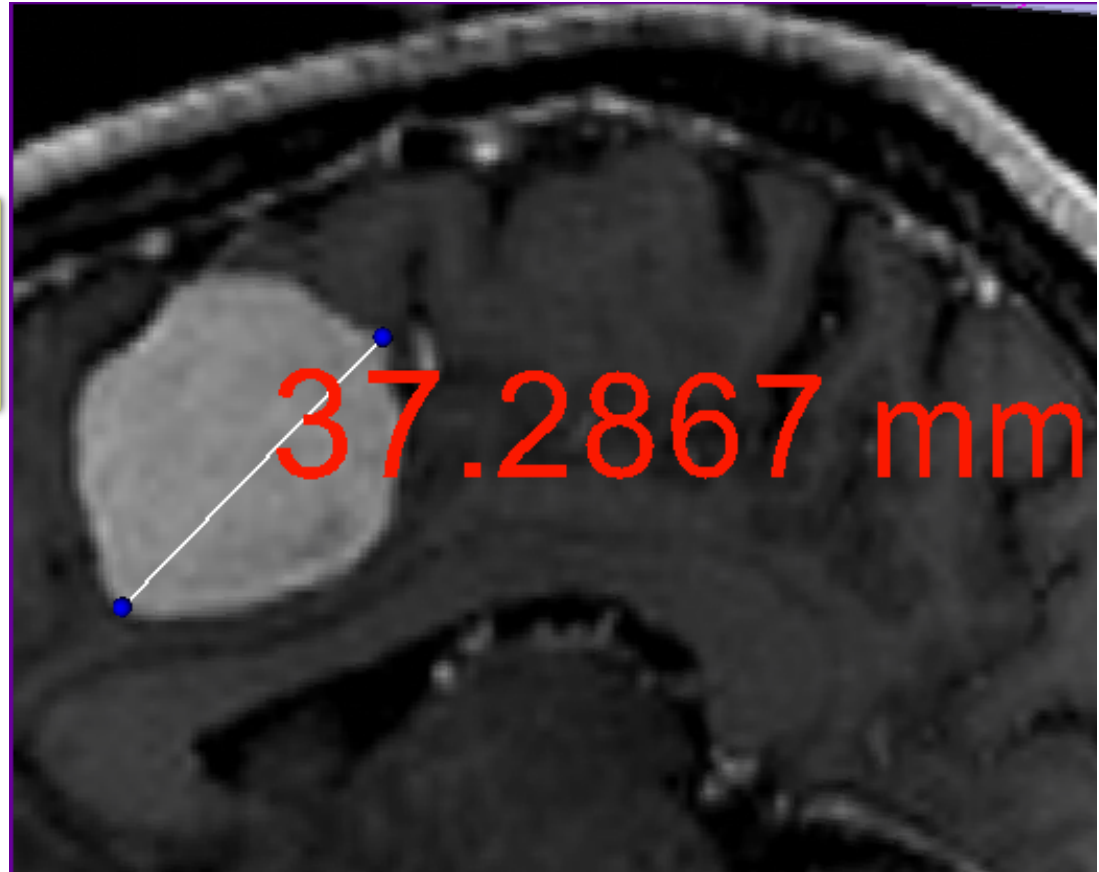




## Quantifying tumor change: Conventional measures of tumor response

3D Slicer's **Measurements module**, provides a measurement widget that operates in the 3D Viewer and the Slice Viewers.

Interactive ruler measures the **longest diameter** and provides numerical **annotations**

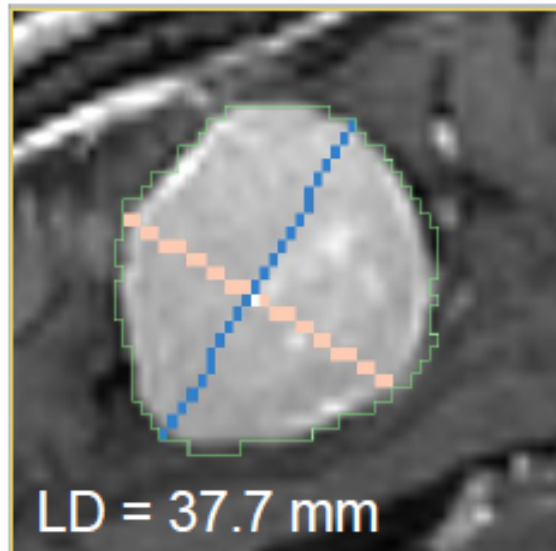




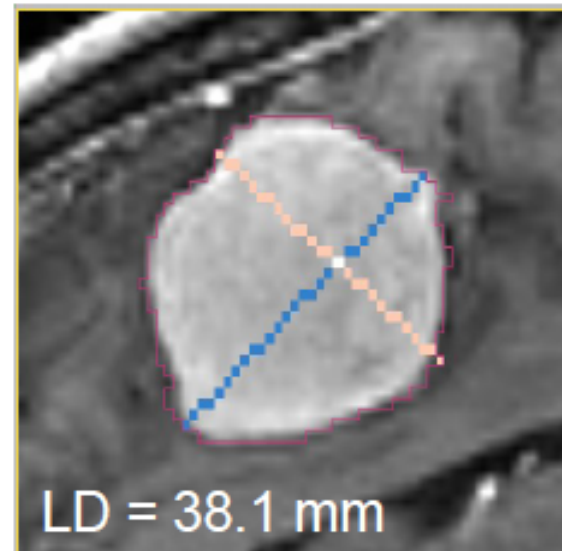
## Quantifying tumor change: Conventional measures of tumor response

3D Slicer's **LabelDiameterEstimation** module will automatically compute the largest tumor diameter.

This analysis requires an **initial segmentation (VOI)**.



Baseline: June 2006



Follow-up: June 2007



## ChangeTracker: rationale for new approaches

---

- However, more accurate and precise methods for understanding volume changes may be useful when:
  - **benign tumor change** is being monitored, or
  - where **small changes may be clinically significant** but difficult to assess with RECIST
  
- **ChangeTracker Module** is a tool to measure **volumetric change at the voxel level.**



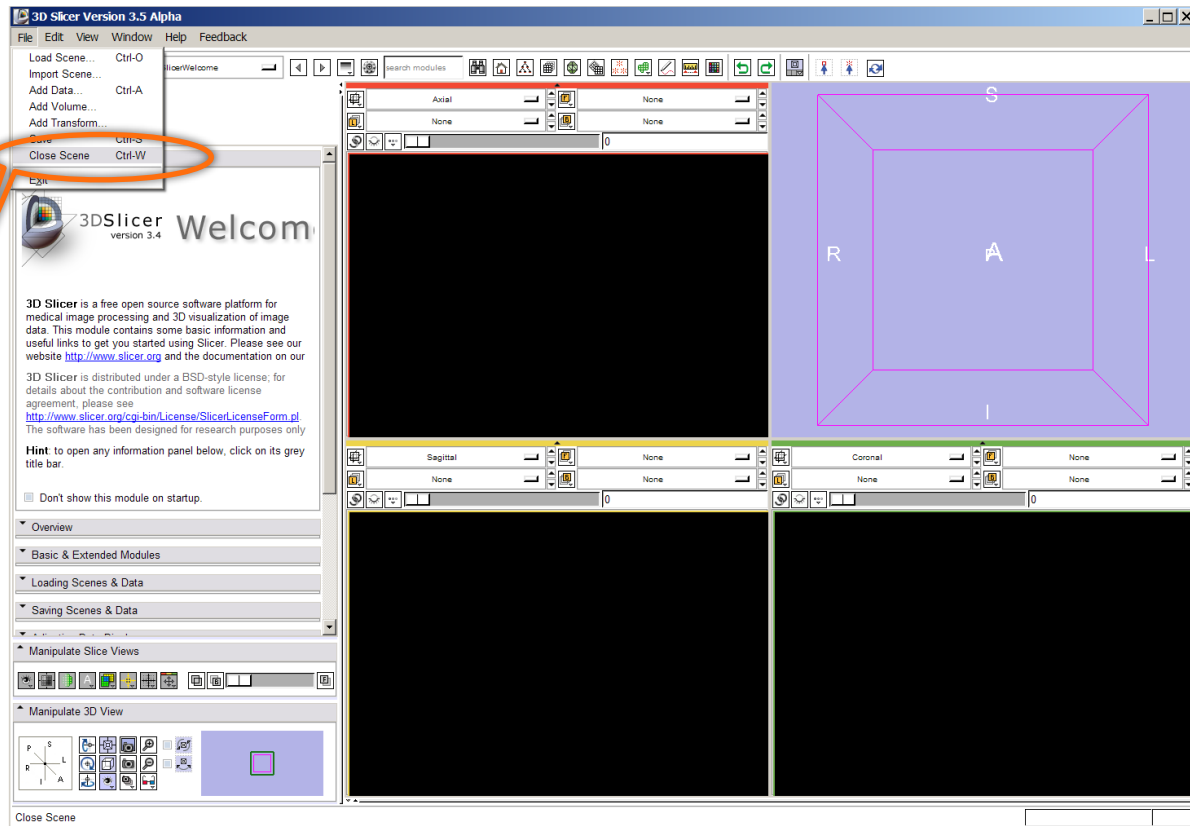
# ChangeTracker: exploring small volumetric changes

3DSlicer

First, close any previous scene.

Select **File->Close Scene**

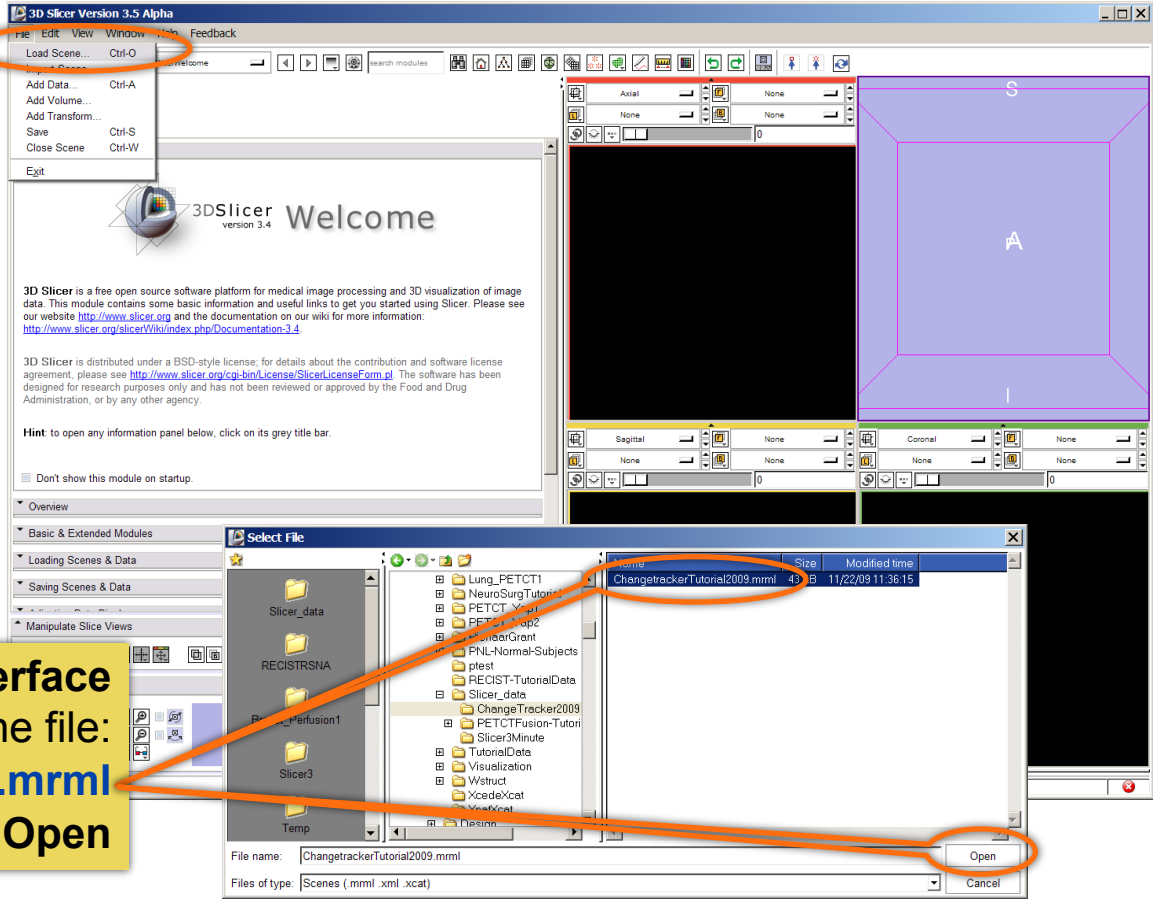
This removes any datasets previously loaded into Slicer.





# ChangeTracker: Load the training dataset

Select File->Load Scene

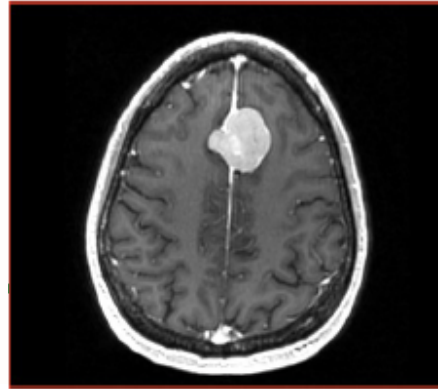


This raises the Load Scene Interface  
select the file:  
**ChangetrackerTutorial2009.mrml**  
double click the file, or click **Open**

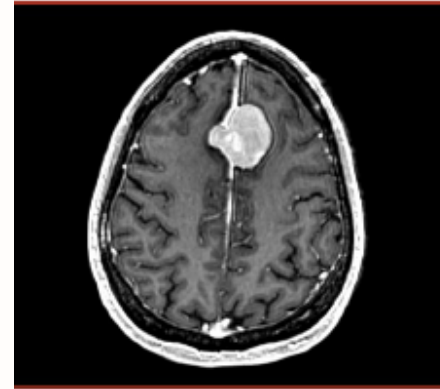


## ChangeTracker: [about the data...](#)

This course is built upon two scans of a patient with meningioma:



MR Scan 1



MR Scan 2

**Please note:** we have **pre-adjusted the window and level settings** for these volumes so that they are appropriate for display on most laptops. If display is not satisfactory on your machine or projector, the Volumes Module may be used to refine these settings.



# ChangeTracker: **Clinical context**

## Meningioma

- Usually benign slow-growing tumors

### Baseline radiologist's clinical impression:

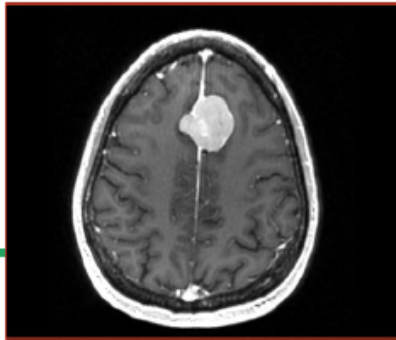
- large falcine lesion is identified.
- measures 3.1 cm anteroposteriorly, 3.05 cm from side-to-side, 3.5 cm in height.
- enhances moderately on post gadolinium imaging.

### Follow-up radiologist's clinical impression:

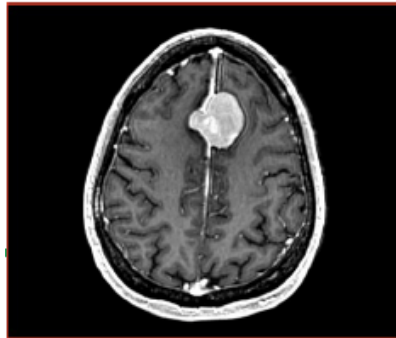
- **left frontal lobe mass appears unchanged on all series.**
- measures 3.3 x 3.2 cm in maximum dimension.
- enhances moderately on post gadolinium imaging.

**How has the tumor changed?**

Baseline:  
June 2006



Follow-up:  
June 2007



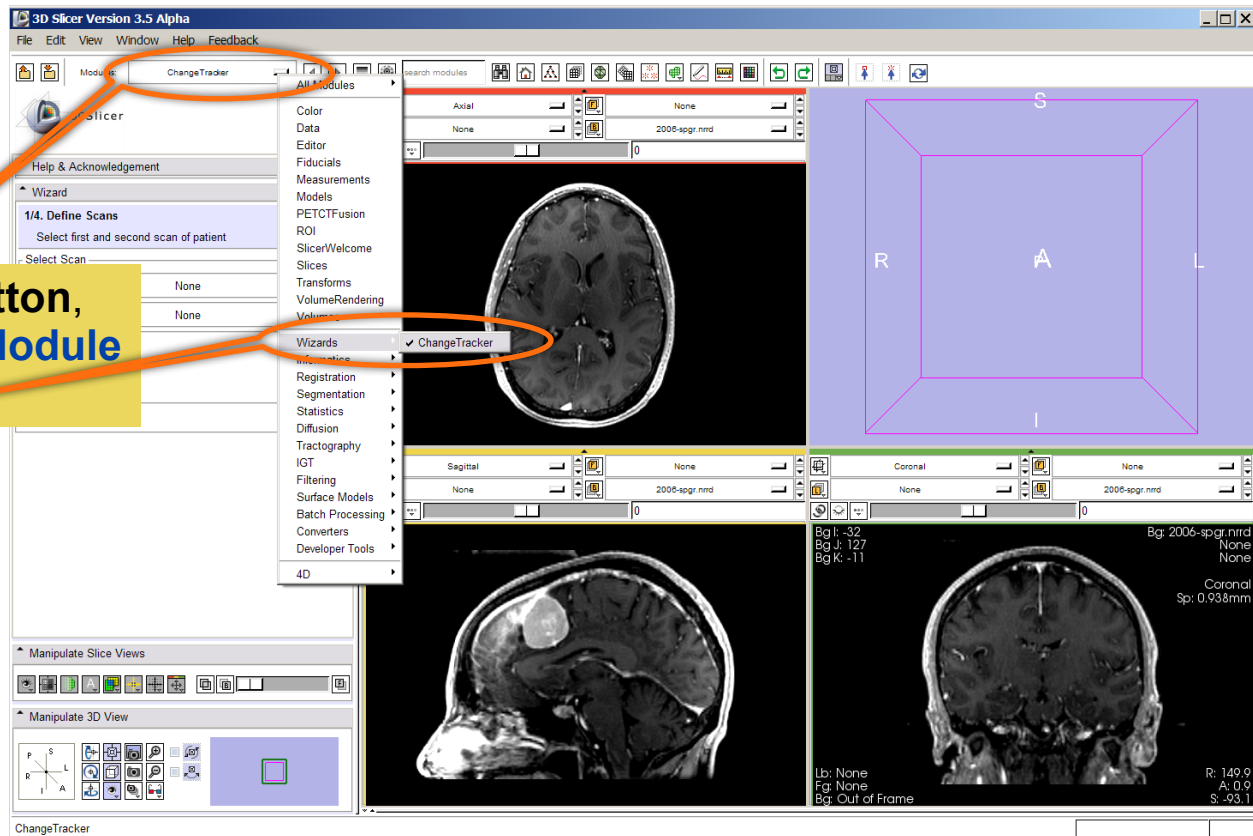






# ChangeTracker: exploring small volumetric changes

Using the **Modules** Menubutton, Select the **ChangeTracker Module** from the **Wizards** category.



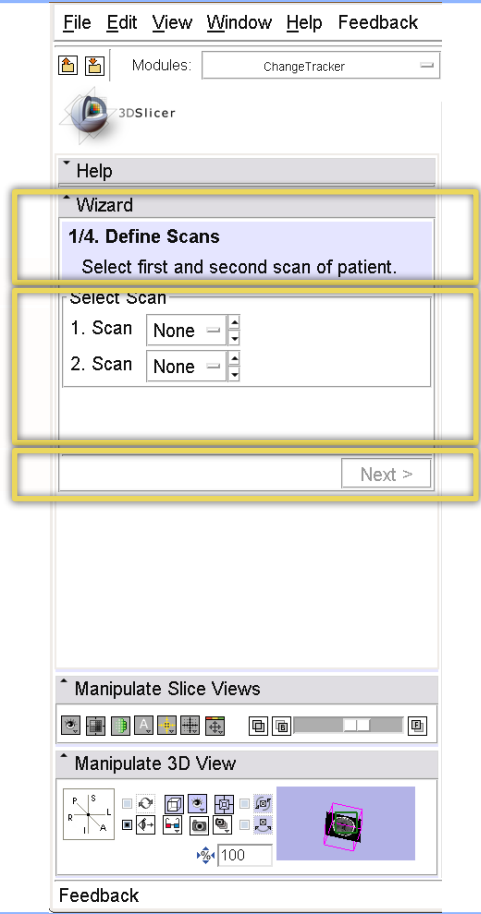


# ChangeTracker: a note about the Workflow Wizard

The **Workflow Wizard** guides the user through a sequence of steps and has the following components:

- the Step Panel
- the User Panel
- the Navigation Panel

Step Panel--  
User Panel--  
Navigation Panel--





# ChangeTracker: First step: select scans

3D Slicer Version 3.5 Alpha

File Edit View Window Help Feedback

Modules: ChangeTracker

ChangeTracker

Wizard

1/4. Define Scans

Select first and second scan of patient.

Select Scan

- 1. Scan 2006-spgr.nrd
- 2. Scan 2007-spgr.nrd

Next >

Manipulate Slice Views

Manipulate 3D View

Middle Button: Pan, Right Button: Zoom

Axial

ChangeTracker

Bg I: 258 Bg J: 200 Bg K: 56

Bg: 2006-spgr.nrd

None

None

Axial

Sagittal

None

2006-spgr.nrd

Coronal

None

2006-spgr.nrd

None

2006-spgr.nrd

Bg I: -32 Bg J: 127 Bg K: -11

Bg: 2006-spgr.nrd

None

None

Coronal

Sp: 0.938mm

Lb: None Fg: None Bg: Out of Frame

R: 149.9 A: 0.9 S: -93.1

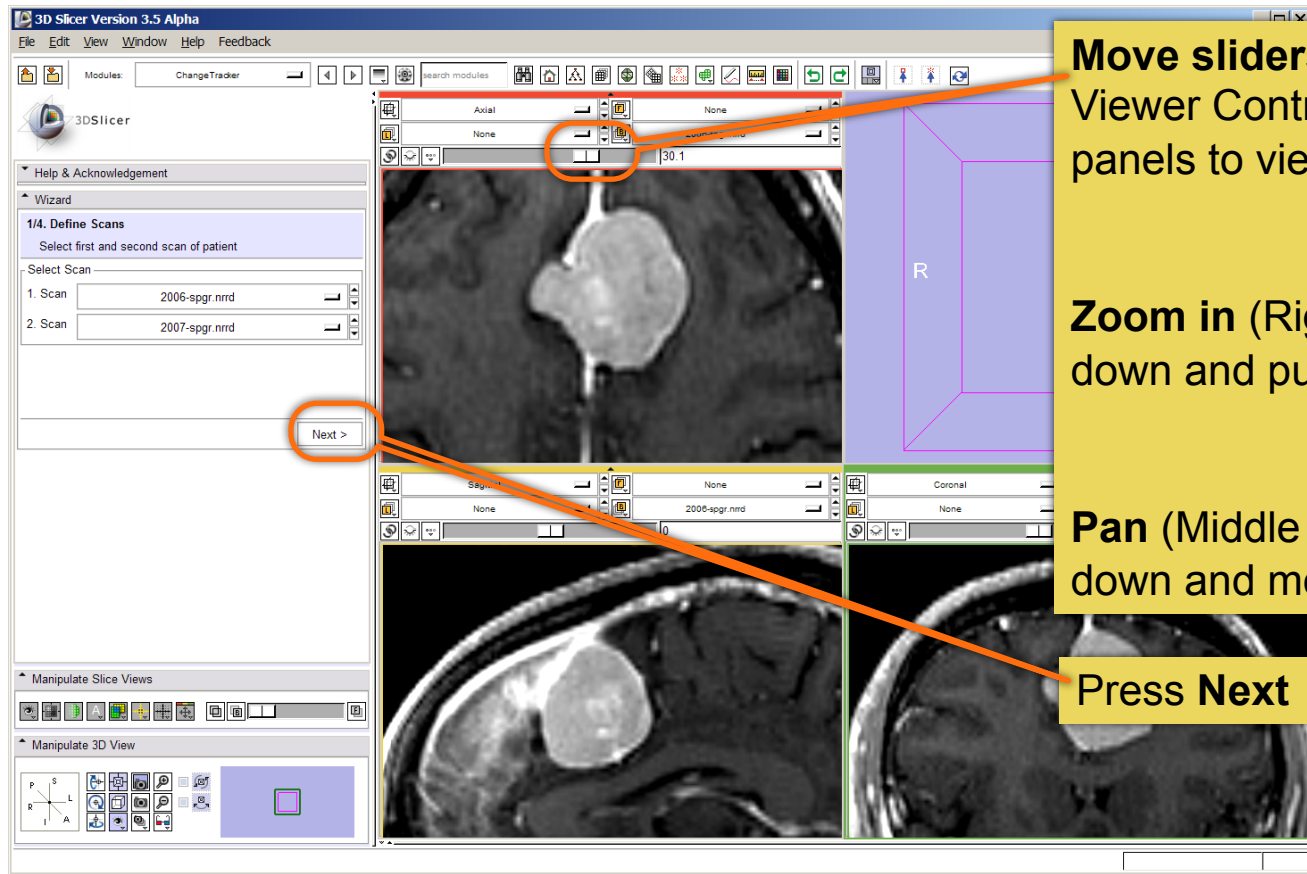
Select:

Scan 1 = 2006-spgr

Scan 2 = 2007-spgr



# ChangeTracker: inspect the tumor



**Move sliders in Slice Viewer Controller panels to view tumor.**

**Zoom in (Right mouse down and push/pull).**

**Pan (Middle mouse down and move).**

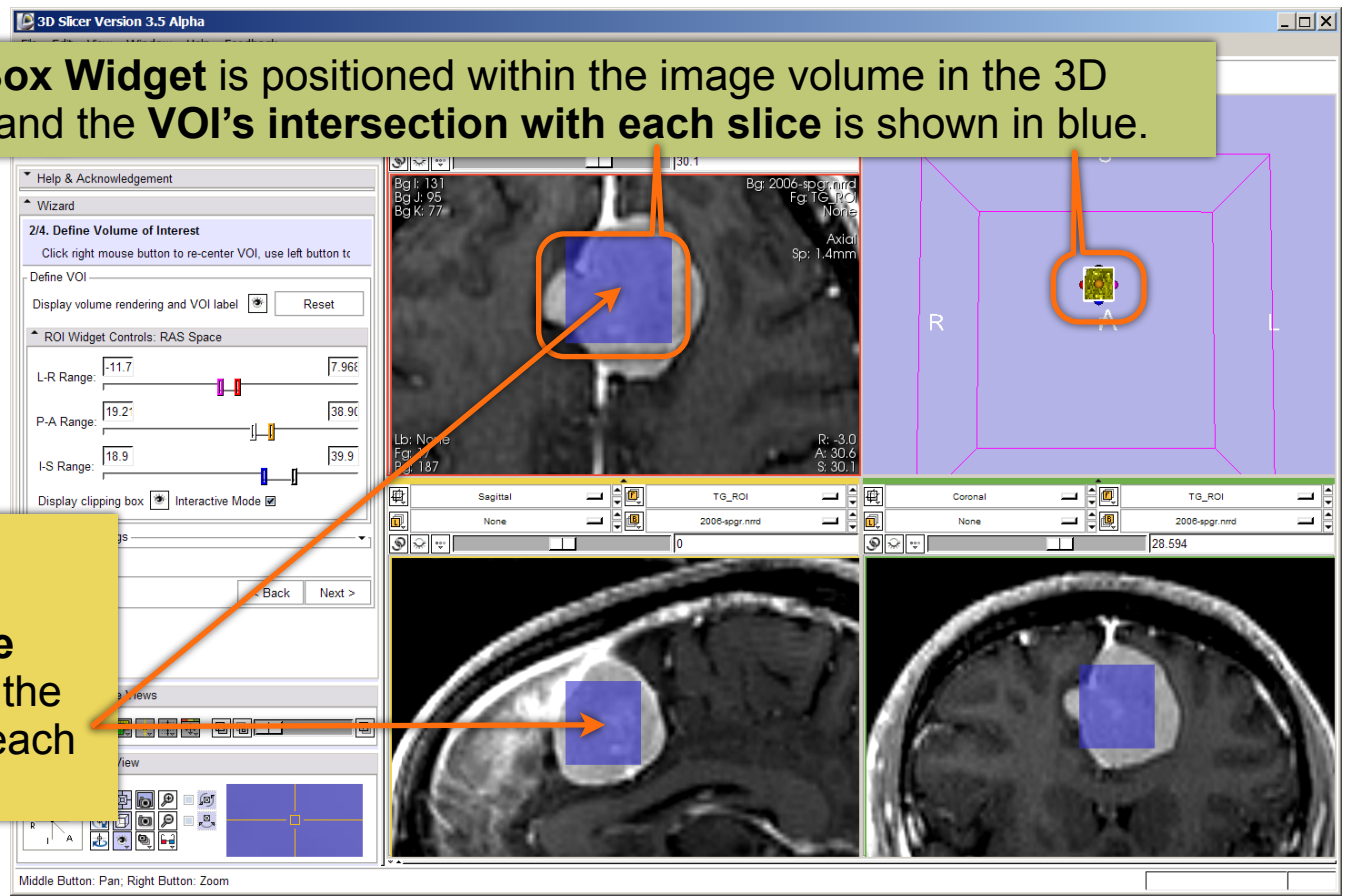
**Press Next**



# ChangeTracker: Step 2. Define a volume of interest

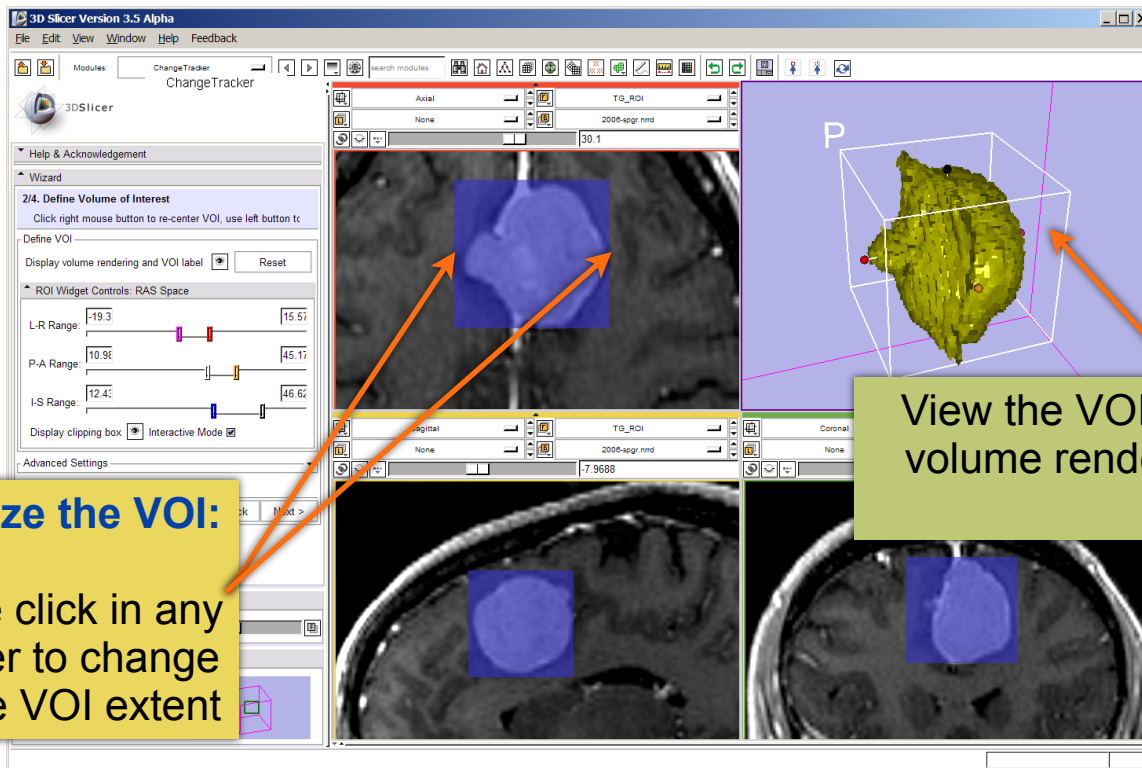
A **VOI Box Widget** is positioned within the image volume in the 3D viewer, and the **VOI's intersection with each slice** is shown in blue.

**Center the VOI first:**  
Right mouse click in the tumor center to position the VOI displayed in blue in each Slice Viewer.





# ChangeTracker: Step 2. Define a volume of interest



**Next, resize the VOI:**  
Left mouse click in any  
Slice Viewer to change  
the VOI extent

View the VOI box widget and  
volume rendering of tumor in  
yellow



# ChangeTracker: Step 2. Define a volume of interest

**Fine-tune the VOI** using the VOI Widget range sliders or by moving the VOI Widget handles in 3D view

Wizard

2/4. Define Volume of Interest

Click right mouse button to re-center VOI, use left button to

Define VOI

Display volume rendering and VOI label  Reset

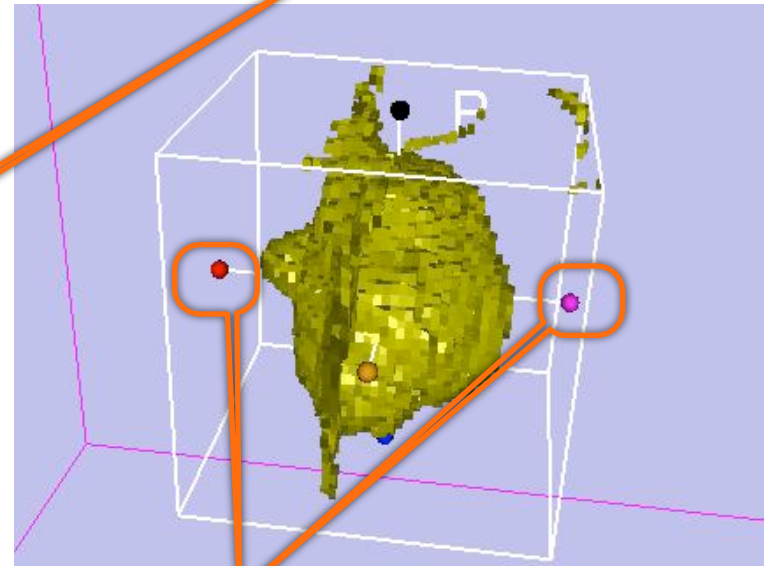
ROI Widget Controls: RAS Space

L-R Range:

P-A Range:

I-S Range:

Display clipping box  Interactive Mode



**Note:** VOI Widget range sliders are **color-coded** to match VOI box Widget **handles** in 3D Viewer

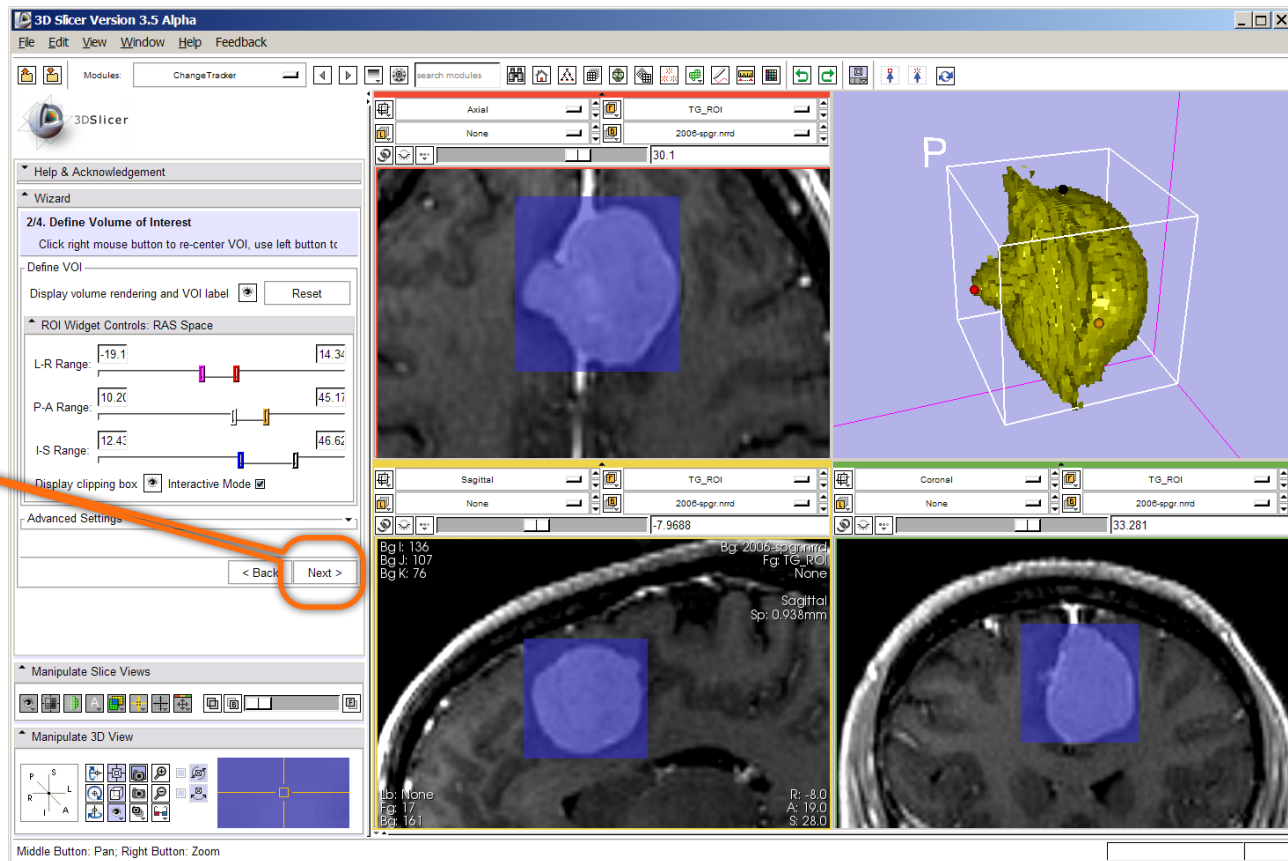




# ChangeTracker: Step 2. Define a volume of interest

Scroll through slices to ensure that tumor boundaries are included in the VOI.

**Click Next**





# ChangeTracker: Step 3. Segment the tumor

3D Slicer Version 3.5 Alpha

File Edit View Window Help Feedback

Modules: ChangeTracker

3DSlicer

Help & Acknowledgement

Wizard

3/4. Identify Tumor in First Scan

Move slider to outline boundary of tumor

Identify Tumor

Threshold: 177.5 | 364

Advanced Settings

Grid Slice < Back Next >

Manipulate Slice Views

Manipulate 3D View

3D Viewer shows model of tumor

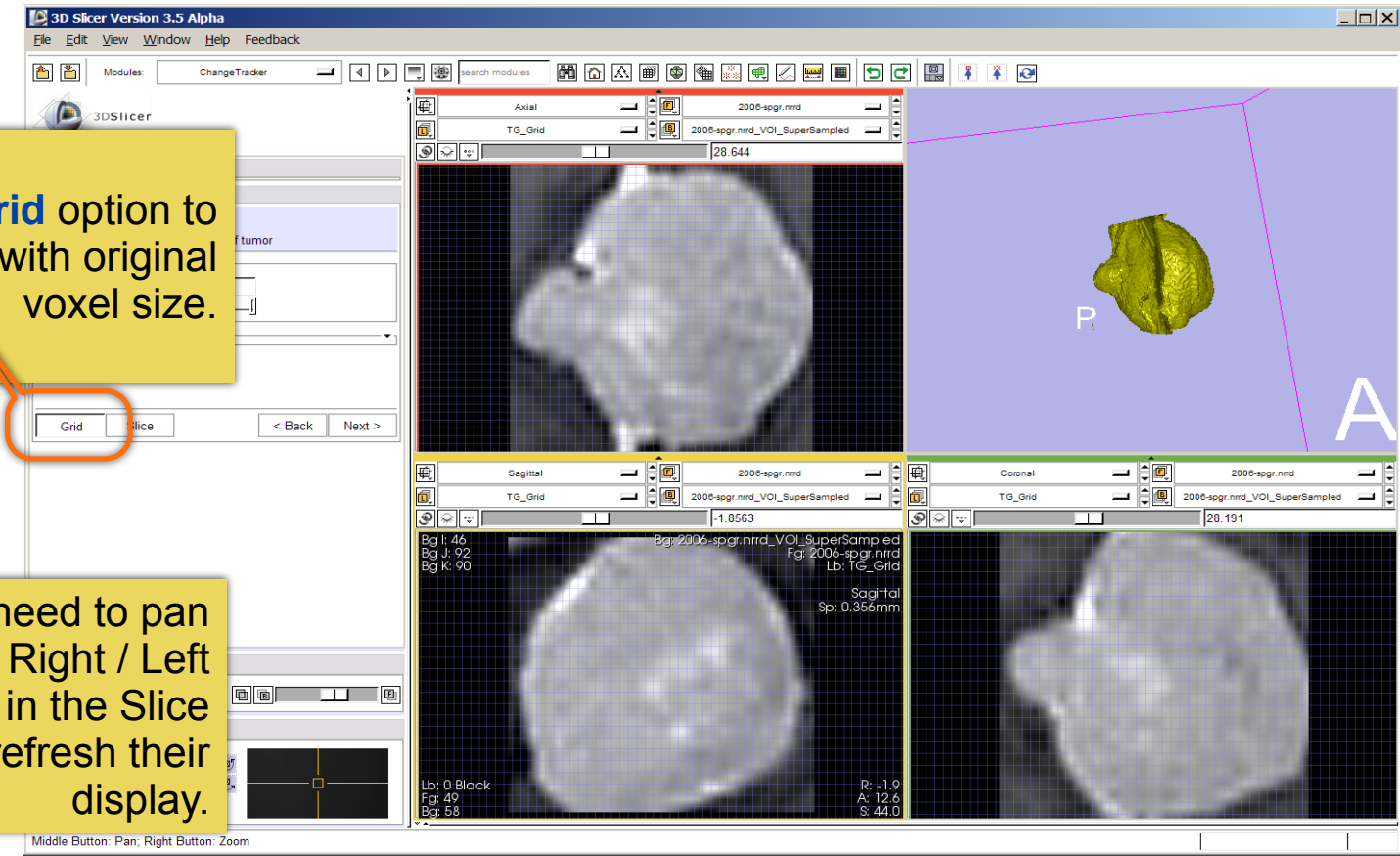
Slice Viewers show VOI with current segmentation overlay in light yellow

Modify the segmentation by moving **threshold range slider**



# ChangeTracker: Step 3. Segment the tumor

Select the **Grid** option to display grid with original voxel size.



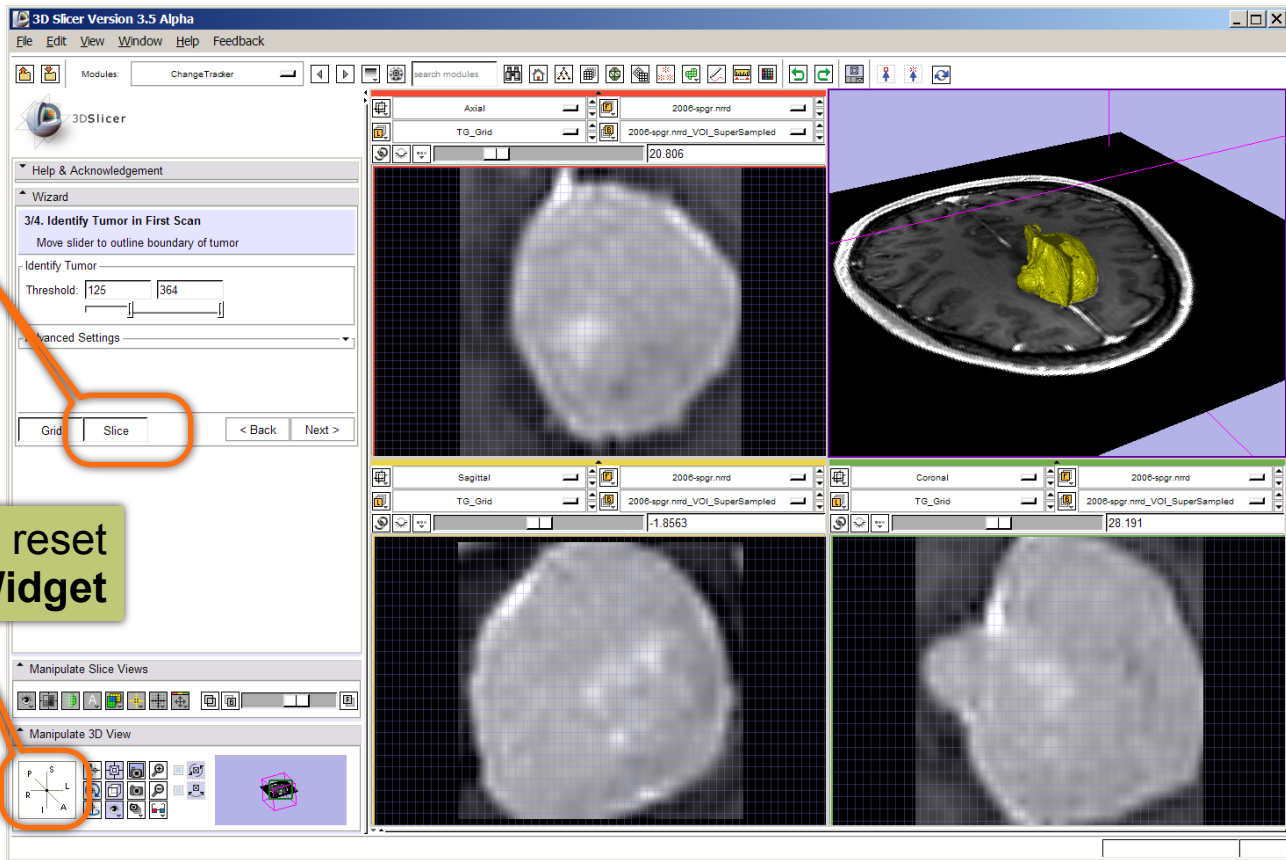
**Note:** You may need to pan or zoom with Right / Left mouse button in the Slice Viewers to refresh their display.



# ChangeTracker: Step 3. Segment the tumor

Select the **Slice** option to see the baseline scan in the 3D Viewer.

**Note:** The 3D View can be reset using the **Axis Navigator Widget**





# ChangeTracker: Step 3. Segment the tumor

Press Next.

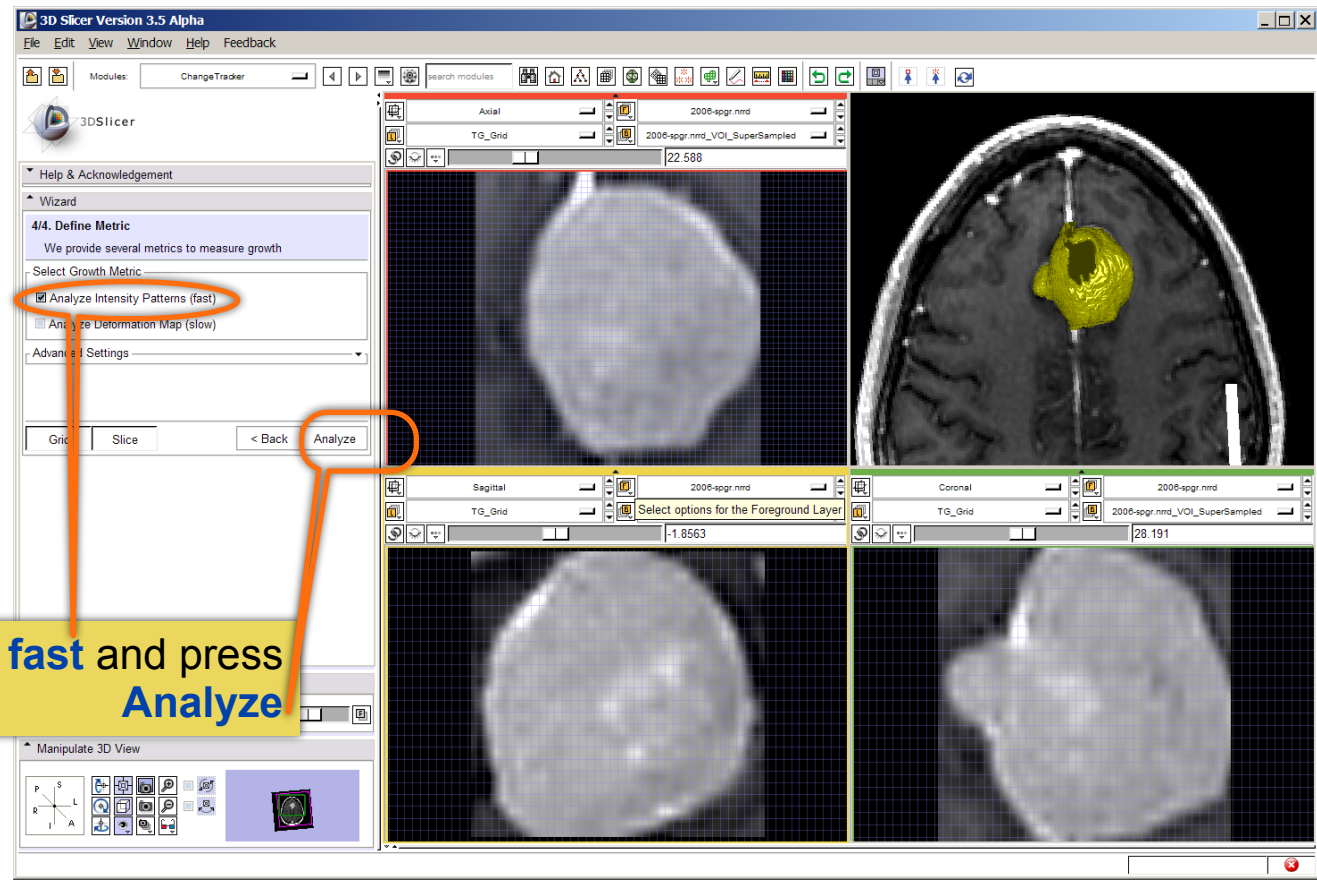
The screenshot shows the 3D Slicer Version 3.5 Alpha interface. The 'ChangeTracker' module is active, and the 'Wizard' is in the '3/4. Identify Tumor in First Scan' step. The 'Identify Tumor' section has a 'Threshold' of 125 to 364. The 'Next >' button is highlighted with an orange circle, and an orange arrow points from the 'Press Next.' text box to it. The main view area shows a 3D rendering of a brain slice with a yellow tumor segment, and three 2D slice views (Axial, Sagittal, Coronal) showing the tumor's position in different planes.



# ChangeTracker: Final step: Select Metric

Metric Options:  
 Detect change by  
 analyzing intensity  
 pattern (**fast**)

Measure change by  
 analyzing  
 deformation map  
 (**slow**)



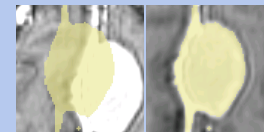
Select **fast** and press  
**Analyze**



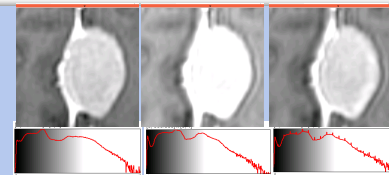
# ChangeTracker: Intensity-based analysis details

Konukoglu et al. ,“Monitoring Slowly Evolving Tumors”, ISBI, 2008

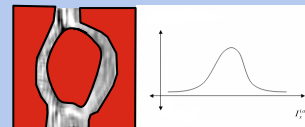
Register baseline and followup (preserve volume)



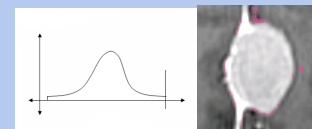
Normalize intensities



Using **segmentation** and **difference image**,  
compute **PDF of dormant tissue**



Set **threshold** for voxel-wise analysis





# ChangeTracker: Results: change in pathology

3D Slicer Version 3.5 Alpha

File Edit View Window Help Feedback

Modules: ChangeTracker

3DSlicer

Help & Acknowledgement

Wizard

Analysis

Analysis of Tumor Growth

Intensity Pattern Analysis

Sensitive  Moderate  Robust

(116 Voxels)  
(243 Voxels)  
(127 Voxels)

Save

Screenshot Analysis Data

Results will be saved to directory:

C:\Documents and Settings\wjp\Local Settings\Temp\Slicer

Grid **Slice** < Back OK

Middle Button: Pan; Right Button: Zoom

Change in volume is shown:  
magenta = growth  
green = shrinkage

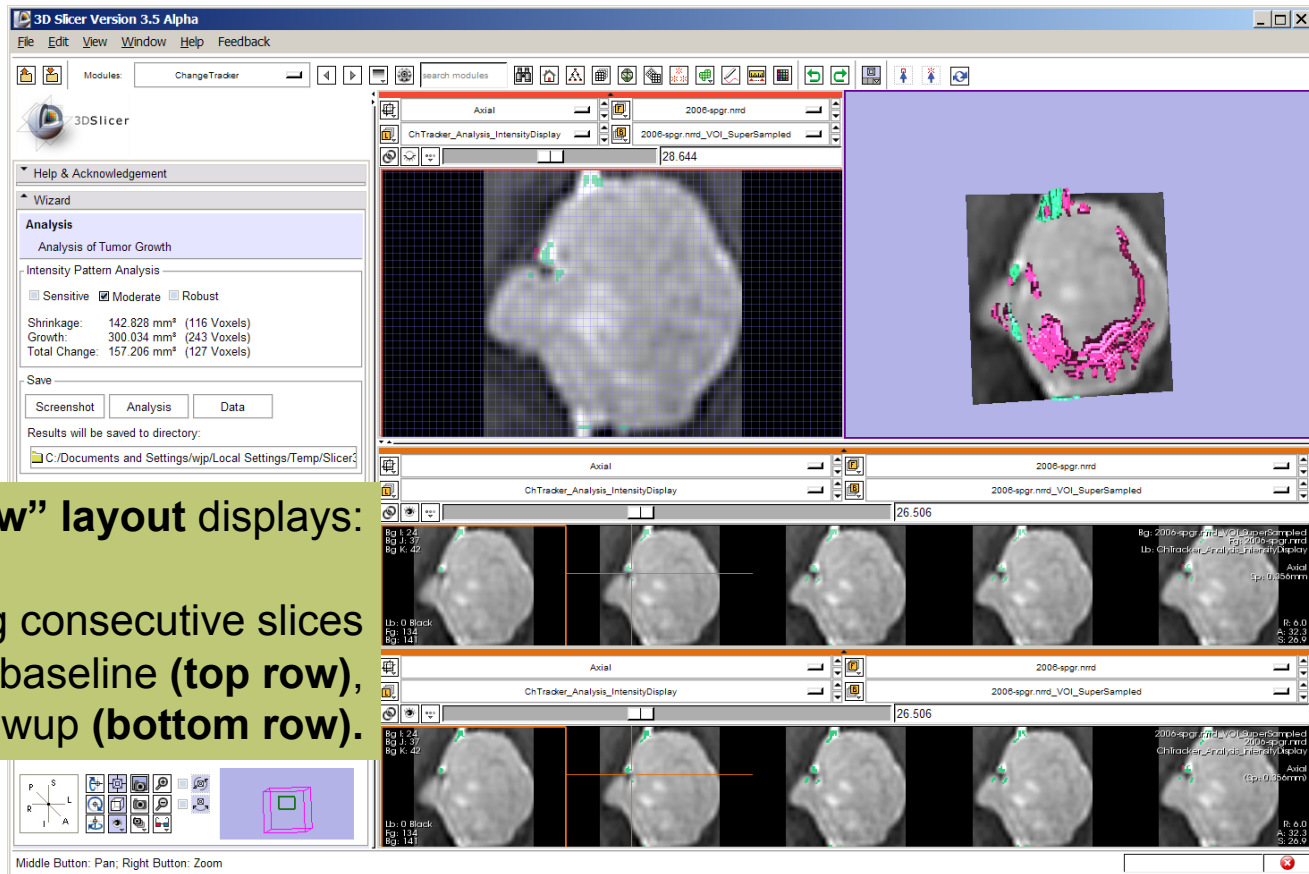
Turn **Slice** option off.

Select visibility icon to show slice in the 3D Viewer





# ChangeTracker: Results: change in pathology



“Compare View” layout displays:  
Five corresponding consecutive slices  
for the VOI in the baseline (top row),  
and in the followup (bottom row).





# ChangeTracker: Exploring small volumetric changes

Define **sensitivity** of intensity pattern analysis

Help & Acknowledgement

Wizard

Analysis

Analysis of Tumor Growth

Intensity Pattern Analysis

Sensitive  Moderate  Robust

Shrinkage: 142.828 mm<sup>3</sup> (116 Voxels)  
 Growth: 300.034 mm<sup>3</sup> (243 Voxels)  
 Total Change: 157.206 mm<sup>3</sup> (127 Voxels)

Save

Screenshot Analysis Data

Results will be saved to directory:

C:/Documents and Settings/wjp/Local Settings/Temp/Slicer3

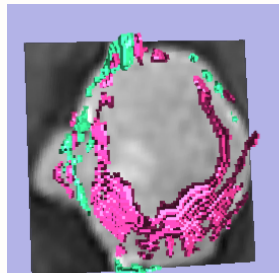
Grid Slice < Back OK

## sensitive

Intensity Pattern Analysis

Sensitive  Moderate  Robust

Shrinkage: 243.458 mm<sup>3</sup> (197 Voxels)  
 Growth: 327.234 mm<sup>3</sup> (265 Voxels)  
 Total Change: 83.776 mm<sup>3</sup> (68 Voxels)

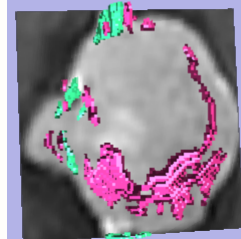


## moderate

Intensity Pattern Analysis

Sensitive  Moderate  Robust

Shrinkage: 164.717 mm<sup>3</sup> (133 Voxels)  
 Growth: 266.577 mm<sup>3</sup> (216 Voxels)  
 Total Change: 101.860 mm<sup>3</sup> (82 Voxels)

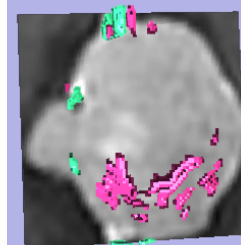


## robust

Intensity Pattern Analysis

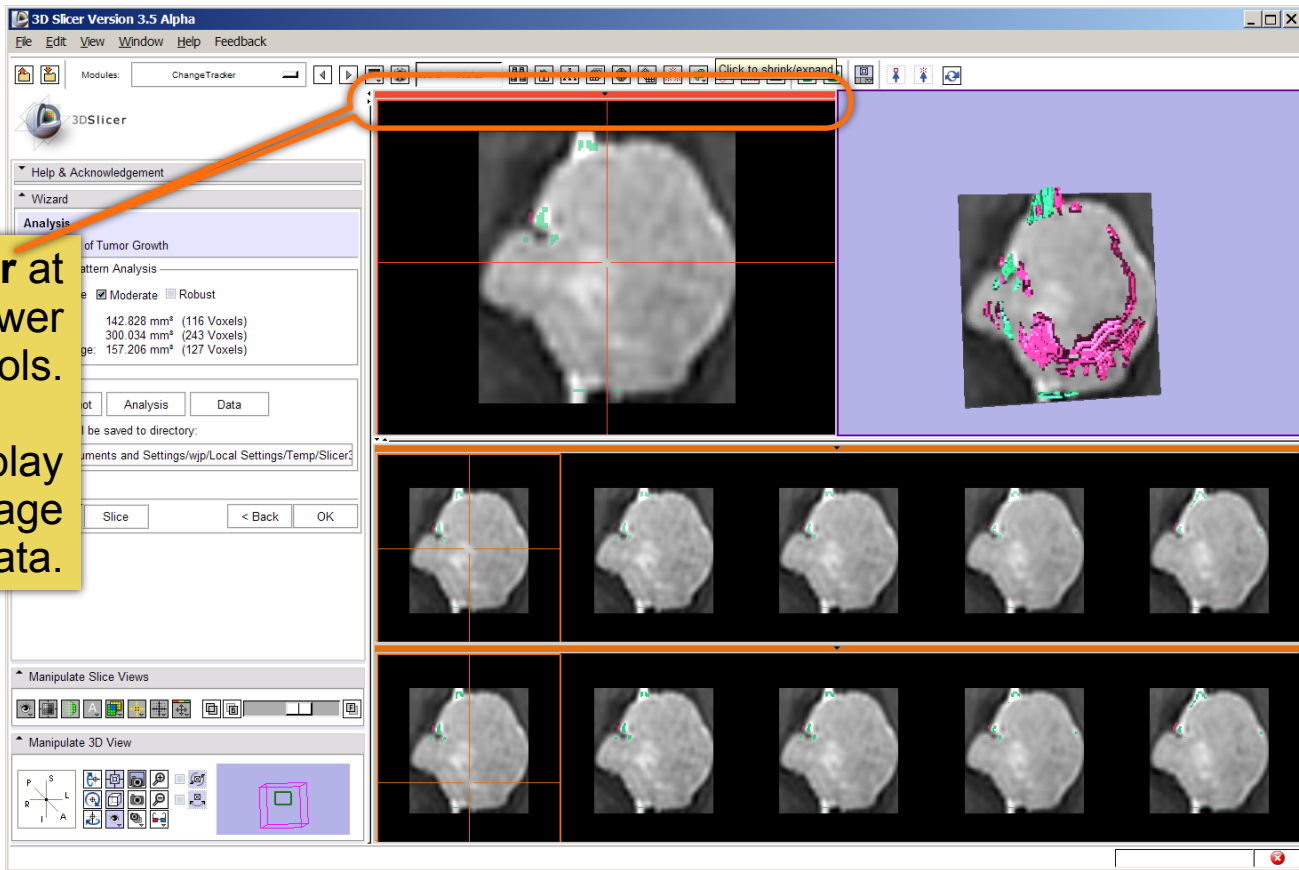
Sensitive  Moderate  Robust

Shrinkage: 116.475 mm<sup>3</sup> (94 Voxels)  
 Growth: 186.418 mm<sup>3</sup> (151 Voxels)  
 Total Change: 69.943 mm<sup>3</sup> (56 Voxels)





# ChangeTracker: Exploring small volumetric changes



Click on the **colored bar** at the top of any Slice Viewer to show or hide the controls.

This allows more display space for viewing the image data.



## ChangeTracker: Exploring small volumetric changes

---

Tested on Axial 3D SPGR T1 post Gadolinium scans (Voxel dimension: 0.94mm x 0.94mm x 1.20mm, FOV: 240mm, Matrix: 256 x 256).

**Tumor boundary should be clear.**

**Only for contrast enhanced images.**

**Need homogenous enhancement across timepoints.**

Not tested for tumors with changing necrosis.

Correspondence between Intensity-based and deformation mapping-based analyses should be checked.



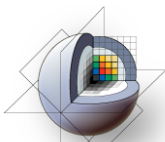
## ChangeTracker: exploring small volumetric changes

---

This tutorial demonstrated:

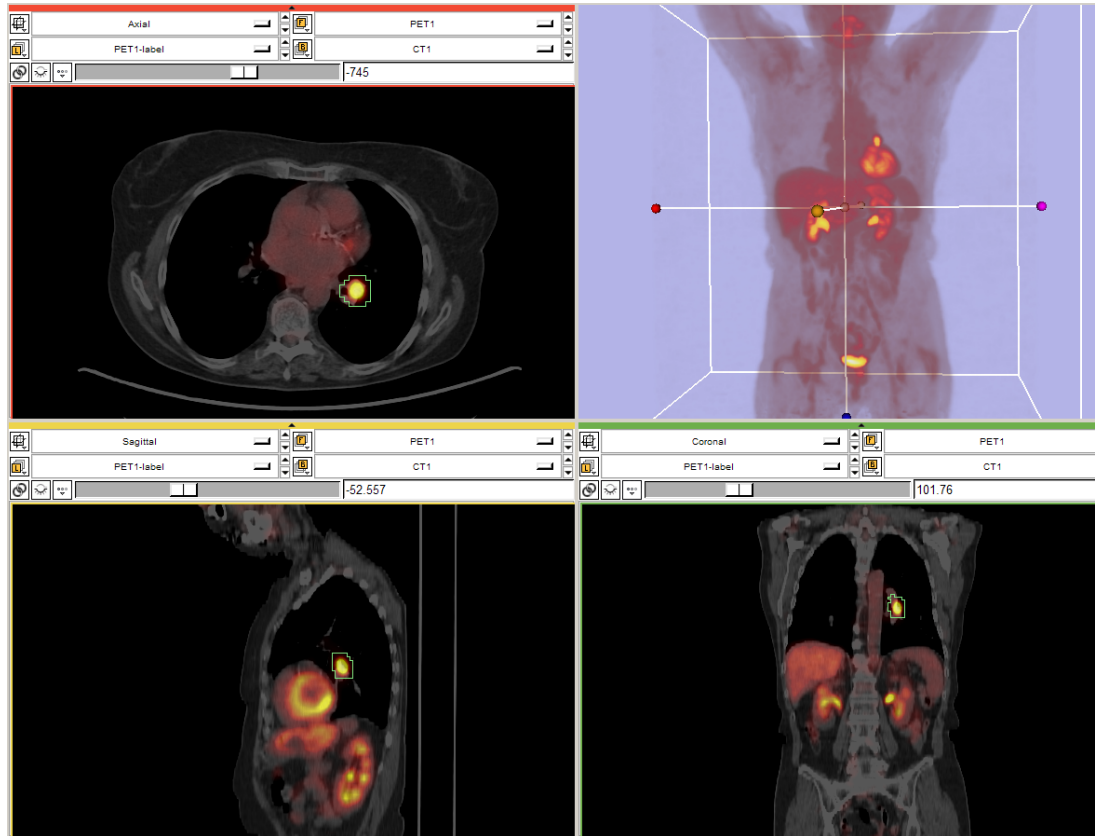
- a method to quantify small volumetric changes in pathology.
- visualization of these changes in the anatomical context
- use of Slicer's "Compare Viewer" to simultaneously explore baseline and followup studies.

Next, we will demonstrate combined visualization of PET/CT studies and SUV computation.



3DSlicer

# PET/CT Visualization and Analysis



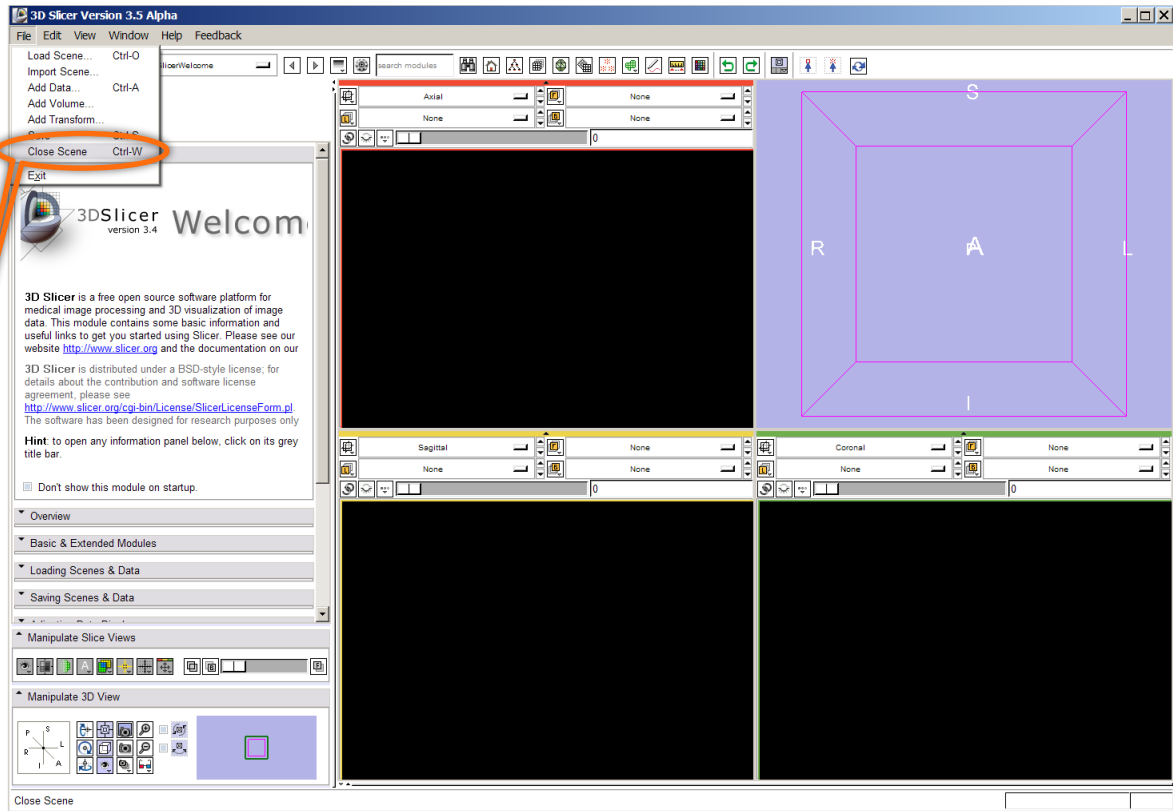
## Part III: *PET/CT Analysis using 3D Slicer*

Jeffrey Yap PhD  
Ron Kikinis MD  
Wendy Plesniak PhD



# PET/CT Visualization and Analysis: Start fresh.

Remove any datasets previously loaded into Slicer:  
Select **File->Close Scene**

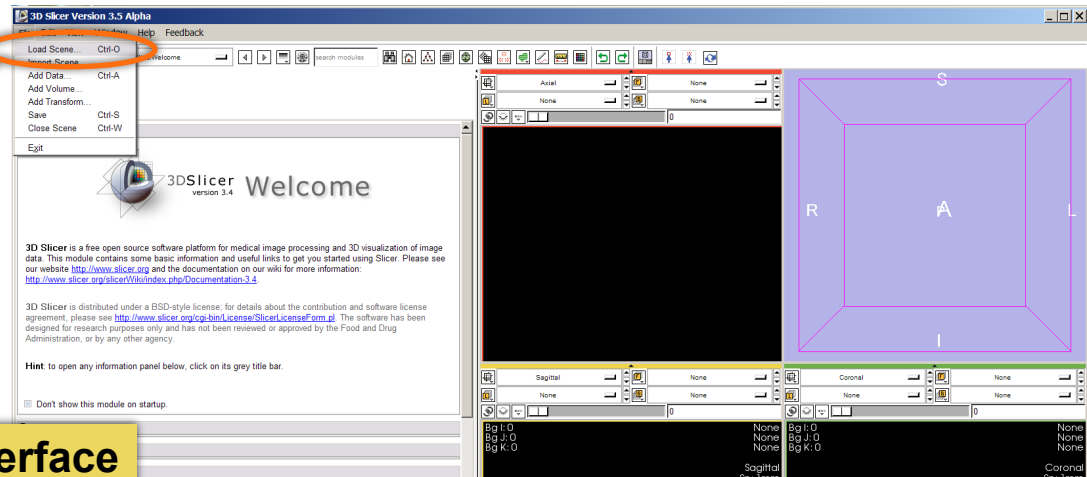




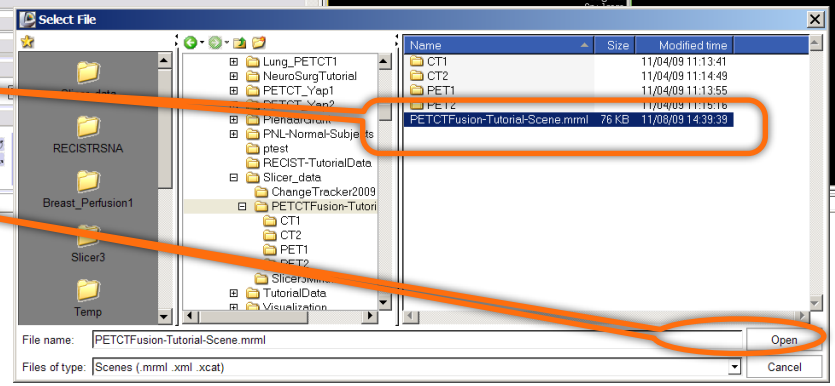


# PET/CT Visualization and Analysis: Load the new scene

Select **File->Load Scene**



This raises the **Load Scene Interface** select the file called **PETCTFusion-Tutorial-Scene.mrml**  
Double click the file, or click **Open**





## PET/CT Visualization and Analysis: **About the data**

---

### **Non small cell lung cancer patient**

**Two PET studies:** **baseline** acquired before treatment, and **followup** acquired 1 month after chemotherapy

Two non-diagnostic CT images are acquired without the use of contrast

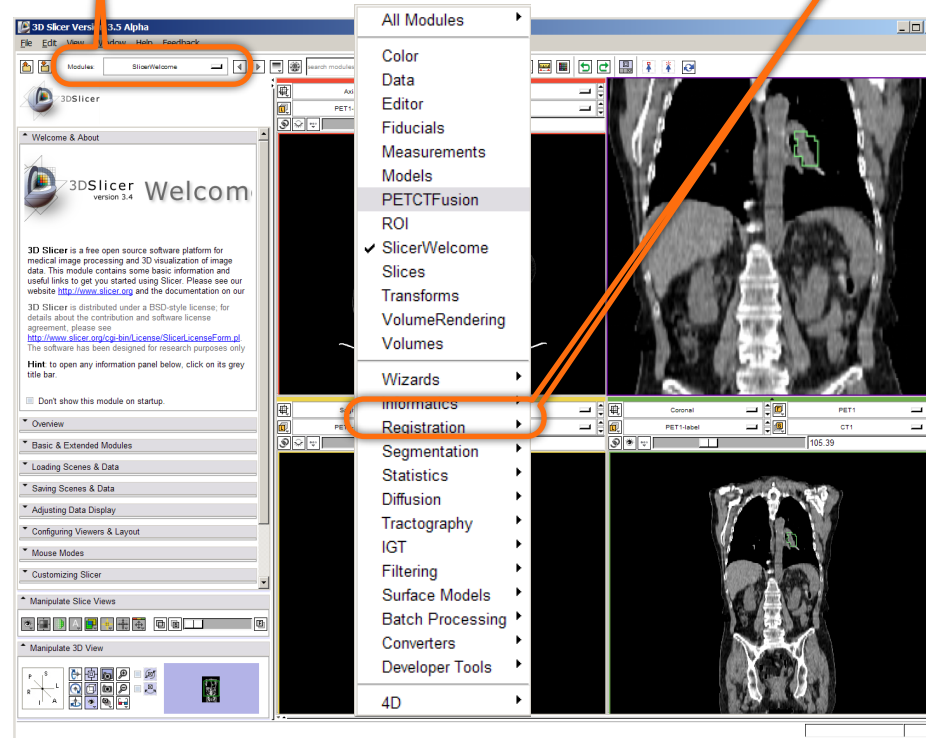
FDG-PET scans acquired 60 minutes after intravenous injection of approximately 20 mCi of  $^{18}\text{F}$ FDG

**Two VOIs** have been created using Slicer's Editor Module.



# PET/CT Visualization and Analysis: Open the PETCTFusion Module

Using **Modules Menubutton**:  
Expose the menu and select the module called **PETCTFusion**.





# PET/CT Visualization and Analysis: **Select baseline study**

**Note:** Module requires DICOM format data

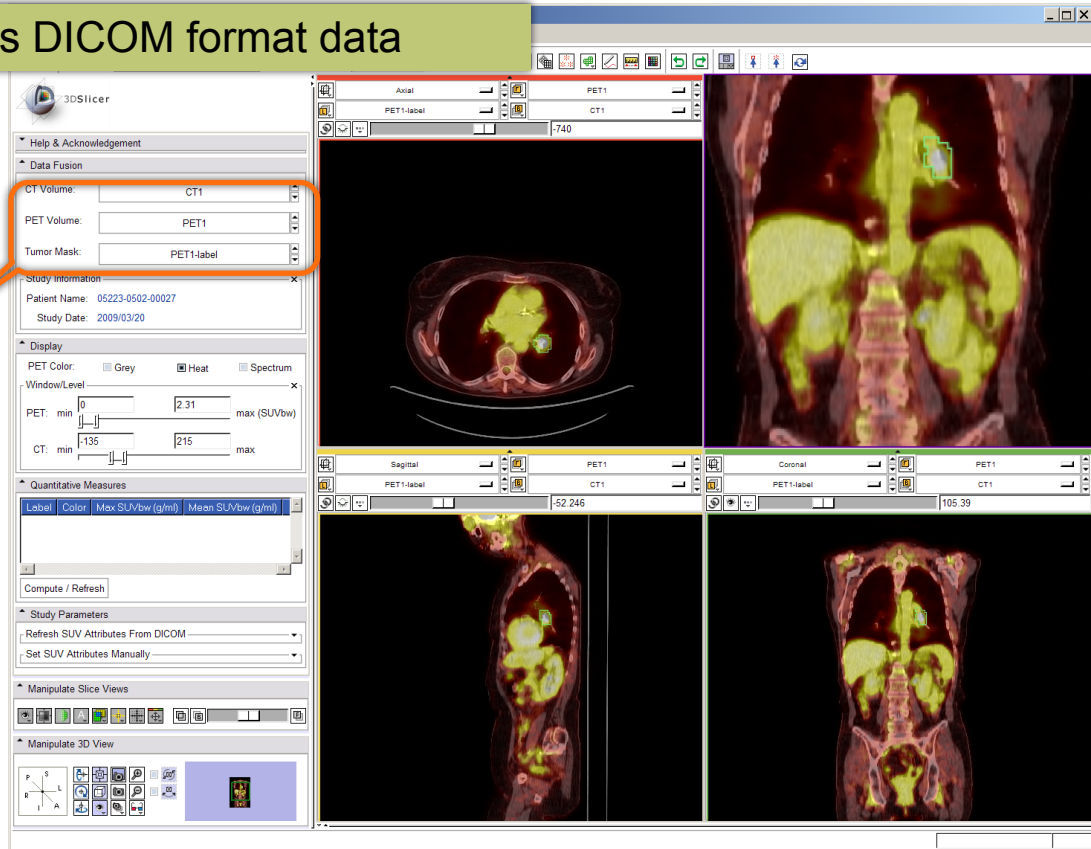
In the Data Fusion panel, select:

**CT volume: CT1**

**PET volume: PET1**

**Tumor Mask: PET1-label**

When the PET volume is selected, a “wait message” will be displayed while parameters are read from DICOM header.





3DSlicer

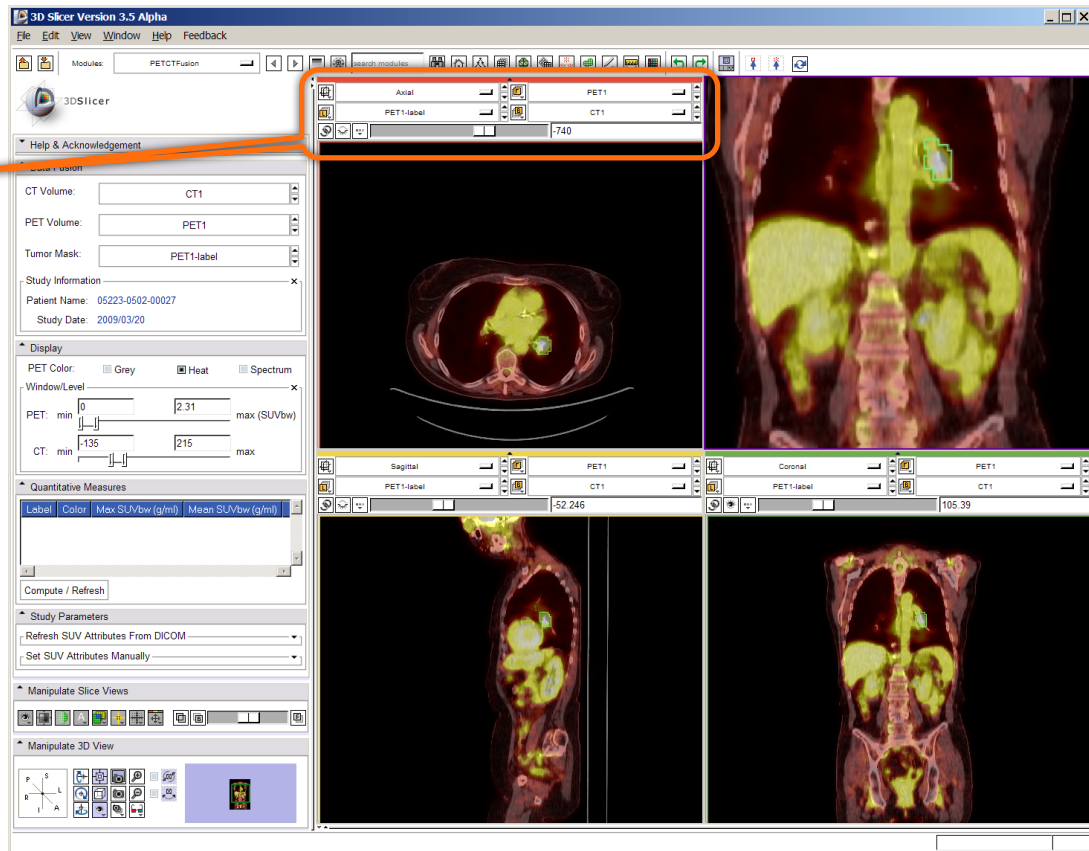
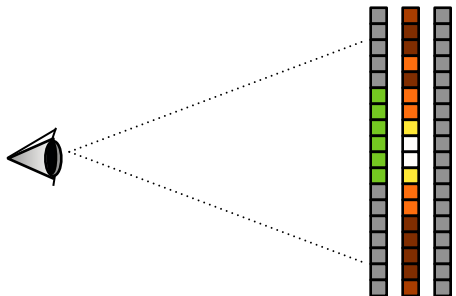
# PET/CT Visualization and Analysis: Information displayed in “Layers”

Note: this stacks the PET, CT and VOI in **three layers**:

**Background = CT1**  
**Foreground = PET1**

**Overlay (Label) = PET1-label**

where they can be blended into a single visualization



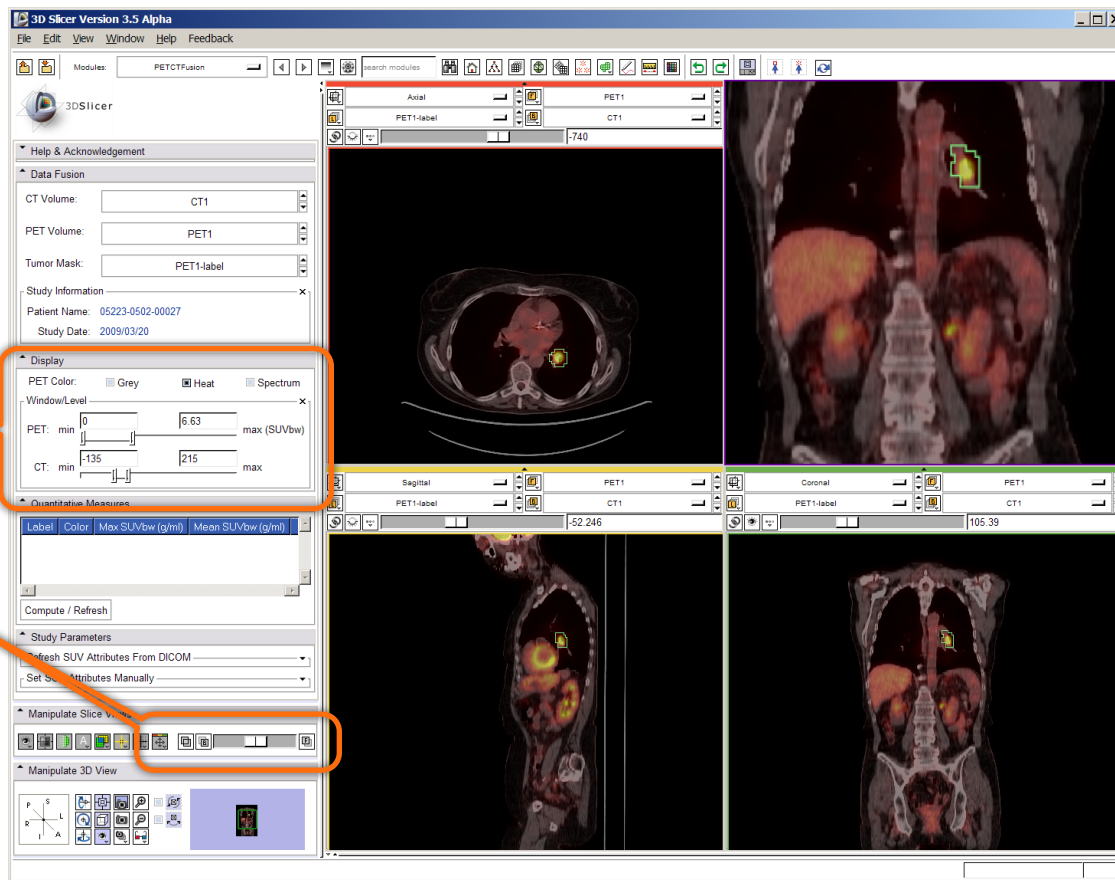


# PET/CT Visualization and Analysis: Adjust display of the baseline study

In the Display Panel, choose a colorization option for the PET volume from among **Grey, Heat, or Spectrum**.

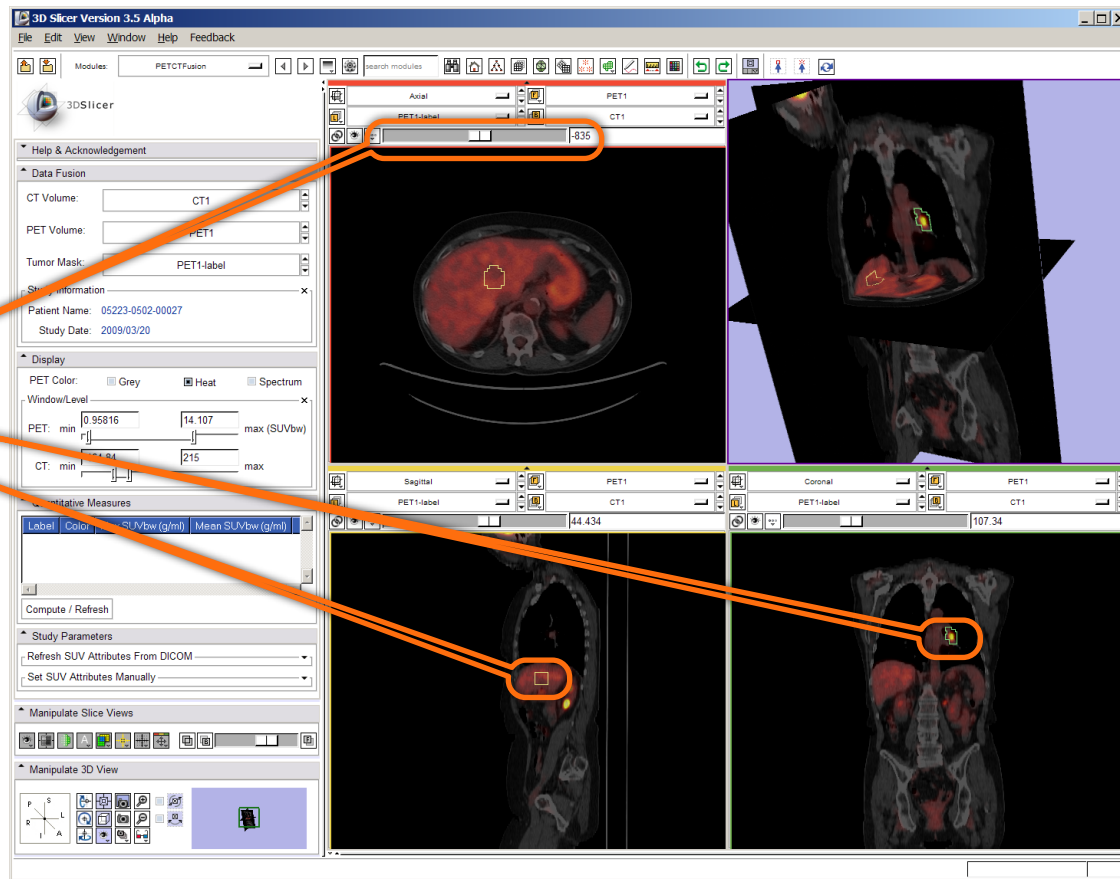
Adjust the **window and level** for CT1 and PET1 volumes.

Adjust the **Slices Fade Scale** to jointly display the datasets in the foreground and background layers.





# PET/CT Visualization and Analysis: Explore the visualization



**Explore:**  
in the Slice Viewers,  
scroll through the slices  
to locate the green **Tumor  
label** and the yellow **Liver  
label**.

**Note:** (the yellow label is  
used only to demonstrate  
multiple-VOI functionality).

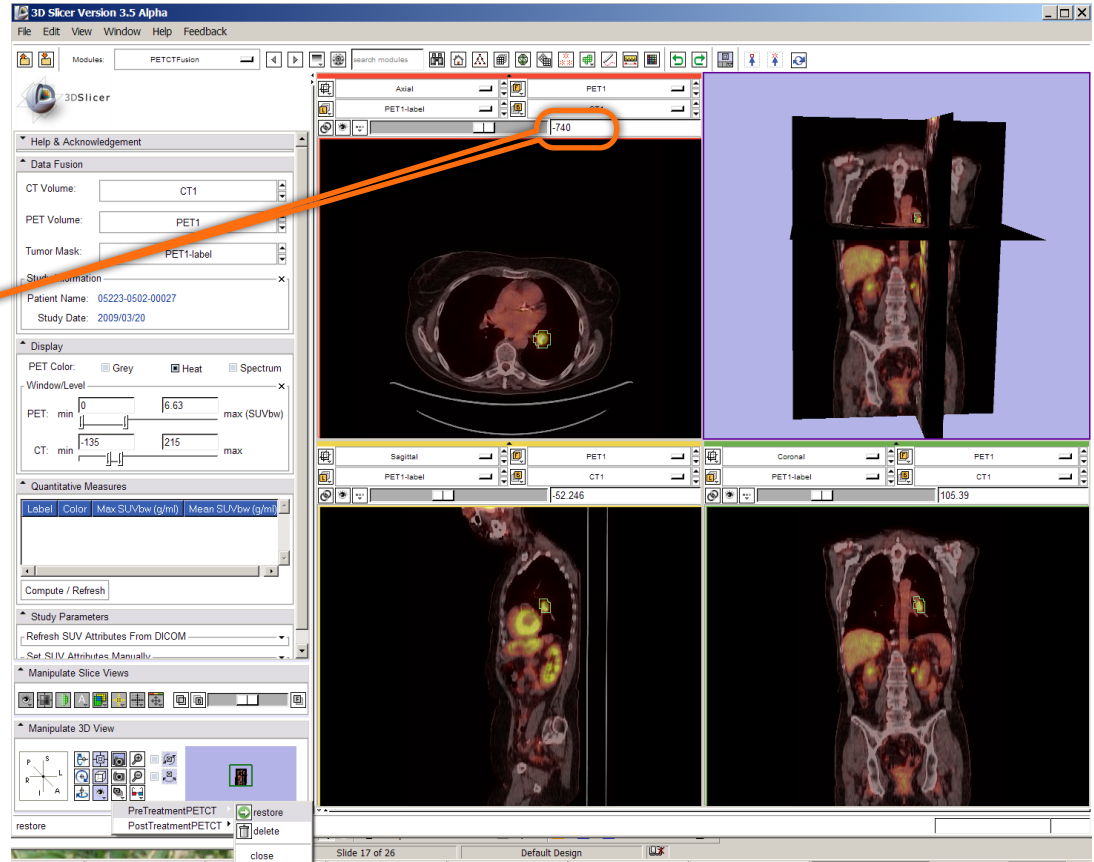


# PET/CT Visualization and Analysis: View tumor in all slice viewers

**Shortcut:** To view the Tumor Label in all Slice Viewers:

Enter **-740** in the **Axial** Slice Viewer's Slice Number Entry ...and...  
**-54** (**Sagittal**)  
**103** (**Coronal**).

These are (mm) positions within the reference frame of the image volumes.







# PET/CT Visualization and Analysis: Compute SUV for all VOIs in baseline

In the Quantitative Measures panel, click the **Compute/Refresh** button

**SUVmax** and **SUVmean** for each VOI (represented by a different color in the label map) will be displayed in the table.

The screenshot shows the 3D Slicer interface with a PET/CT fusion. The Quantitative Measures panel is open, displaying a table of SUV values for two VOIs. The 'Compute / Refresh' button is highlighted with an orange circle.

Label	Color	Max SUV/bw (g/ml)	Mean SUV/bw (g/ml)
6	Green	8.019048	2.410283
8	Yellow	3.638906	2.870964



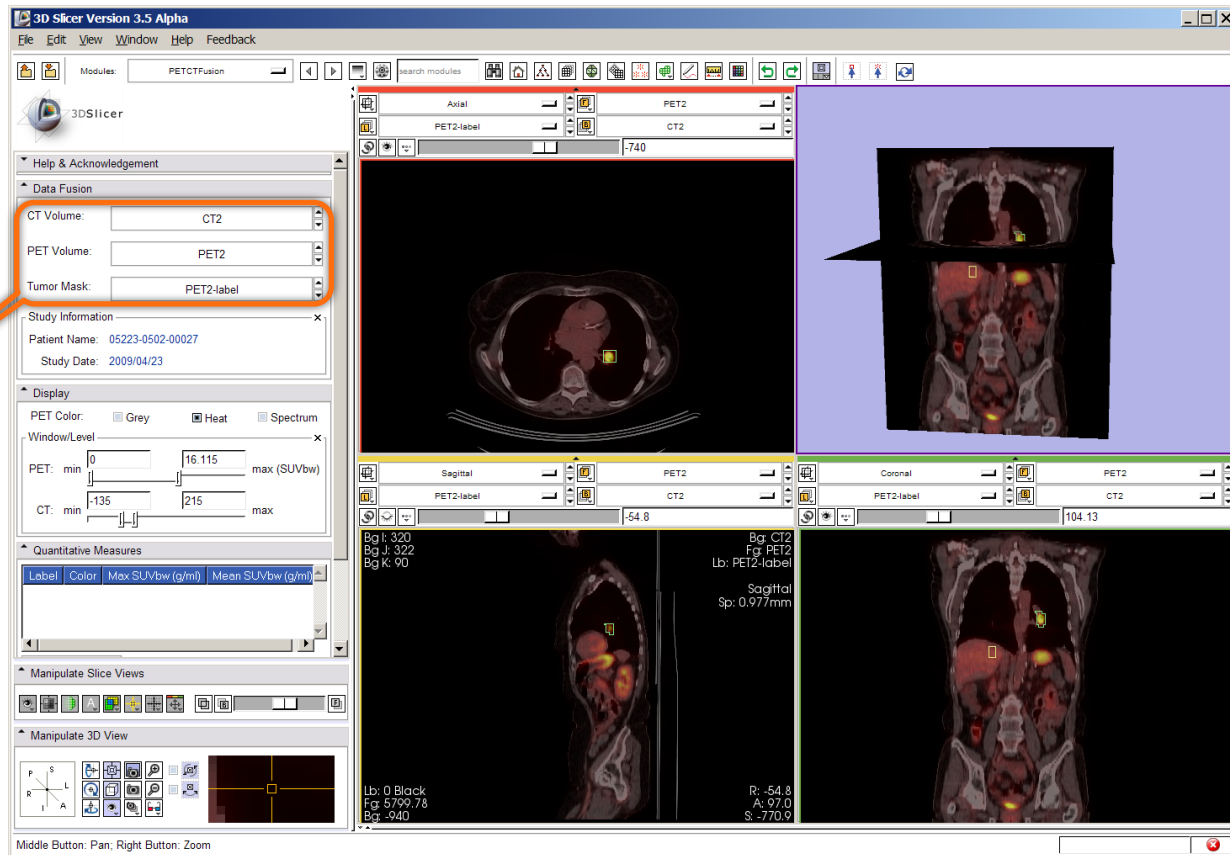
# PET/CT Visualization and Analysis: Compute SUVbw for follow-up study

Look for **response to treatment** in the follow-up study:

In the **Data Fusion** panel, **set:**

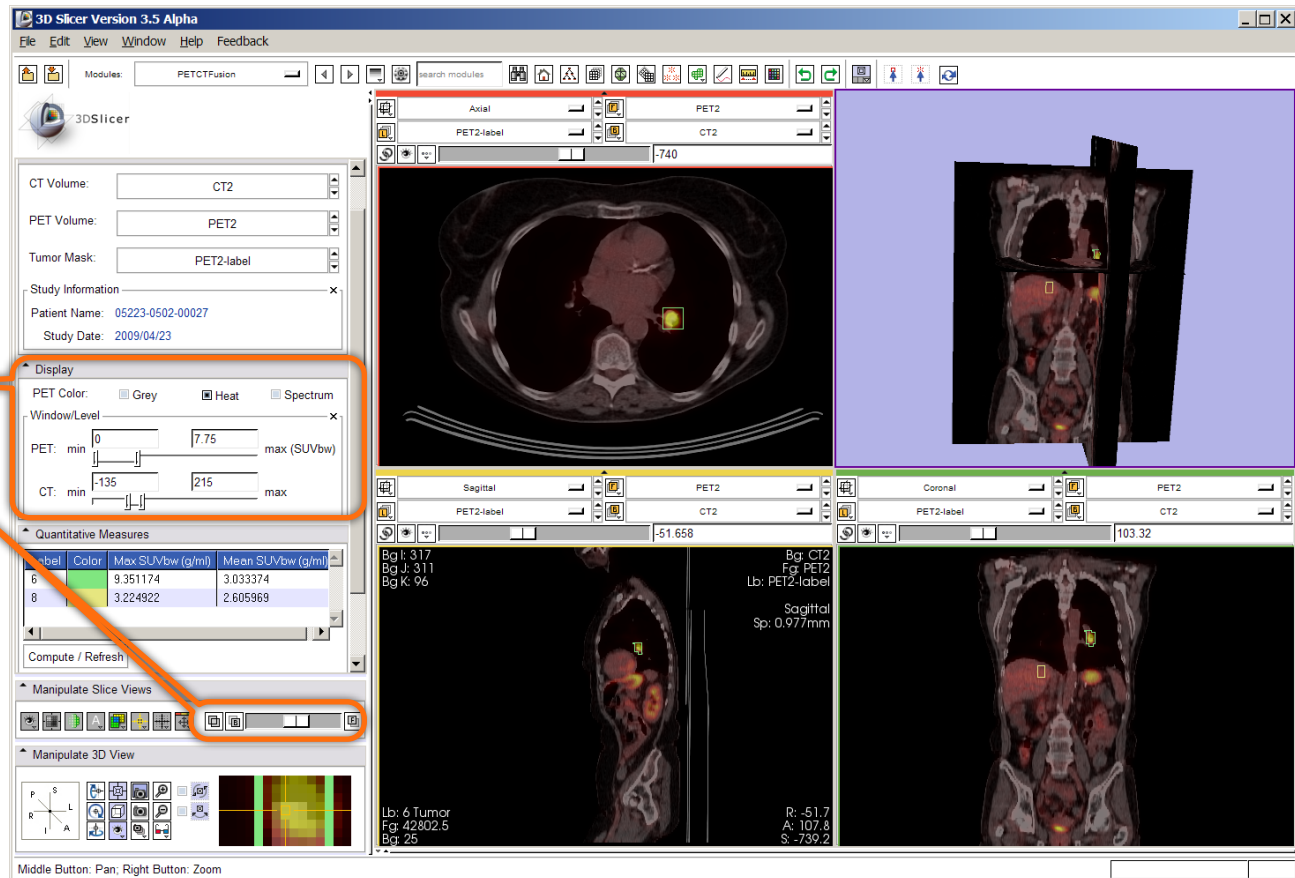
CT volume = **CT2**,  
PET volume = **PET2** and  
Tumor Mask = **PET2-label**.

This dataset contains two **VOIs** that correspond to the segmentations the baseline study.





# PET/CT Visualization and Analysis: **Modify display of the follow-up**



Adjust the **display** for the follow-up study.

You may want to adjust the **Slices Fade Slider** and manipulate the 3D View to refresh them.





## PET/CT Visualization and Analysis: **Assess response wrt this VOI**

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Pre-Treatment Max SUVbw = 8.0

Post-Treatment Max SUVbw = 9.4

**+16.61% (SD)**



## PET/CT Visualization and Analysis: **Appropriate Use**

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Still validating this module against performance of commercial systems.

Appropriate only for DICOM PET studies only

Not compatible with Philips datasets



# Workshop Summary

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## **This workshop has demonstrated:**

- Basic scene loading and visualization using 3D Slicer
- Use of Slicer's ChangeTracker module to assess small changes in tumor size
- Workflow to make quantitative measurements of SUV (body weight) in Slicer's PETCTFusion module



## Workshop Summary: Slides and Datasets

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### Tutorial Slides:

<http://wiki.na-mic.org/Wiki/images/4/4e/Combined-RSNA09-WJP.ppt>

### Tutorial Data:

<http://wiki.na-mic.org/Wiki/images/5/51/Slicer3MinuteDataset.zip>

<http://wiki.na-mic.org/Wiki/images/f/f8/RSNA-ChangeTracker-Tutorial-Data.zip>

<http://wiki.na-mic.org/Wiki/images/7/73/PETCTFusion-Tutorial-Data.zip>

### Tutorial Software:

<http://www.na-mic.org/Slicer/Download/Snapshots/win32/Slicer3-3.5-RSNA-2009-11-06-win32.exe>

### More Information:

<http://www.slicer.org>





# Acknowledgements

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Harvard Clinical and Translational Science Center



National Alliance for Medical Image Computing  
NIH U54EB005149



Brain Science Foundation



INRIA, France



Neuroimage Analysis Center (NAC)



National Center for Image-Guided Therapy (NCIGT)



Surgical Planning Laboratory, Brigham and Women's Hospital